ARCHIVES

OF

OPHTHALMOLOGY

EDITED IN ENGLISH AND GERMAN

BY

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IN CONJUNCTION WITH

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ERRATA.

Page 171. Commencing at fifth line from bottom: Instead of eleven, read *four* square metres. Instead of cubic, read *square* feet; and instead of one hundred and twenty, read *eleven and a half* cubic metres.

ARCHIVES OF OPHTHALMOLOGY.

CONTRIBUTIONS TO THE STUDY OF CHORIO-RETINITIS PIGMENTOSA.*

By Dr. J. N. OELLER, of Munich.

Translated by Dr. Swan M. Burnett, of Washington.

(*Plates X, XI, and XII.*)

IN the following pages I submit a contribution to the study of chorio-retinitis pigmentosa. The case which serves as the basis of my remarks furnishes so many interesting pathologico-anatomical points as to justify a detailed consideration.

Taken singly these offer nothing that is specially new, but when taken collectively they assume the highest importance. For the specimen I am indebted to the kindness of Dr. Schauber of Augsburg.

The only history of the case we have is, that the patient (now 37 years old) was struck on the right eye with a whiplash by another child, when he was one year old. The pupil has become clouded since childhood. For a year and a half the eye has been subject to repeated attacks of inflammation. During the first attack, a physician whom he consulted ordered some drops (atropine) after which the cloudiness was more marked. The repetition of the attacks of inflammation and the severe pain in the right side of the head, led to the enucleation of the eye. The left eye was normal.

The enucleated eye lay about three weeks in Müller's

* Condensed from the original which appeared in vol. viii, pp. 435–483, German edition of these Archives.

fluid, and was then transferred to absolute alcohol. I divided it by a horizontal section; its antero-posterior axis measured 21 *mm.*, its transverse, 23 *mm.*

Macroscopic appearances.

On opening the globe the most marked pathological alteration which strikes the eye is a long cone (see Fig. 1 Pl. x) having its base on the inner side of the outer ora serrata, its direction is forward and inward, and it rapidly diminishes in size. The very solid cone evidently springs from the retina. It measures in its greatest length 6 *mm;* its base is 5 *mm*, and seems attached to the choroid. Its color is that of the retina—yellowish-gray. It extends along the ora serrata, like a comb with sharply defined edges, for about two-thirds of the circumference of the bulb in such a manner as to form a sort of circular detachment of the retina. The cone ends with a somewhat obtuse angle to which is attached a roll of very fine, cobweb-like bluish gray membrane, which is stretched horizontally across the vitreous chamber and joined on the other side with the hyaloid, and the edge of the detached retina. This membrane occupies the space between the pupillary area and the cone, measuring about 3.5 *mm.* Even with the naked eye it is evident that the post. memb. is strewn with collections of pigment.

The retina exhibits the characteristic picture of retinitis pigmentosa of typical form.

A wide pigmented zone is seen about the equator, which is composed of collections of pigment, partly punctate, partly stellate and partly linear, and often confluent in form.

From the equator two bands of pigment 2 *mm.* broad run toward the optic nerve entrance, terminating about 2 *mm.* in front of it. Forward from the equator the pigment is more scattering, though some collections, punctate and stellate in form, are found close to the base of the retinal detachment. On attempting to lift the retina from the choroid, the fine fibres connecting them are felt to give way.

At some places, particularly at the broad pigment band mentioned above, one of which passes through the macula lutea, the adhesion is so strong that the two membranes cannot be separated without tearing. Even macroscopically the unequal thickness of the retina is apparent. At the place of adhesion at the macula, it is reduced to the thinnest possible membrane, while at other places it assumes various thicknesses. It is more rigid, less soft and pliable than retinæ hardened in the usual way. When it is turned back, a fine network of pigment is seen on its outer surface.

The choroid likewise presents marked macroscopical alterations. That the retinal epithelium next to it is atrophic, is shown by the uncommonly sharp outlines of the choroidal vessels. But at some few places on the anterior surface of the choroid, both before and behind the equator, black pigment is found, which assumes a regular shape. It is in the form of stripes, with here and there a small break, reminding one of the ramifications of a vessel; not those of the choroid, however, because it runs in a direction across these. In Fig. 1, Pl. x, I have drawn the anterior half of the globe enlarged four times, and there will be seen at this point a faint line of pigment passing around from the cut surface, which apparently runs in the retina. If, however, the retina is lifted up, a black line about 6 *mm.* long will be seen on the choroid, whose course crosses that of the choroidal vessels. Besides these bands there are round patches of pigment of various sizes, which are sometimes isolated and sometimes collected in groups of three and four. The largest lie in front of the equator, and measure about 1¼ *mm.* in diameter. Some, not the smallest, are circular, with a bright centre. There is seen throughout, however, a thin membrane, which seems to be the normal choroid.

Alteration was also macroscopically evident in the optic nerve. The outer edge of the o.n. is considerably higher than in the normal. The edge, however, rapidly falls to a very shallow porus, to pass over to the inner edge with a scarcely perceptible elevation. Corresponding to the elevation of the outer edge, there is to be seen in the substance of the inner

layer a round mass with a diameter of about 0.5 *mm.* In consequence of this, the outer surface of the choroid is pushed somewhat backward (Fig. 5, Pl. xii).

As regards the anterior portion of the globe, conjunctiva, cornea, sclera and corpus ciliare were normal, the only pathological alterations found being in the lens, the contents of the aqueous and vitreous chambers and in the iris.

The lens was dislocated into the anterior chamber, and the iris was pushed somewhat back by it, making the anterior chamber deeper than usual, especially at the pupillary space, where it measured 4 *mm.* in depth.

The lens is nowhere in contact with the posterior surface of the cornea. It lies on the anterior surface of the iris, and is fixed there by fine filaments arising from the inner zone of the iris and from the vitreous and retina (fibres of the zonula). There were, moreover, delicate membranes connecting a part of the pupillary edge of the iris to the lens. Under the microscope, these threads and membranes were found to consist of connective tissue which was in part pigmented. To complete the macroscopical appearance, I will add that the space behind the membranes, which are attached to the circular retinal detachment, is filled with a light, cloudy mass.

Microscopical appearances.

The vessels of the conjunctiva bulbi, the limbus and episclera are crowded with red blood corpuscles, and some newly-formed vessels are found some distance in the substance of the cornea close to Bowman's membrane. In the sheath of the larger vessels and in the adjacent tissue numerous lymphoid cells are found. These cells, with coarse granules, which are also found in a limited number in the choroid and iris, were found in great quantities along the walls of the vessels and free in the conjunctival tissue. The epithelium is everywhere intact. Bowman's membrane is regularly but decidedly thickened (0.015 *mm.*).

We encounter the above-mentioned large cells with deeply-colored nuclei and coarse granular protoplasm, though in limited numbers, along the sclera back to the entrance of

the optic nerve. Here and there between the scleral bundles they assume a spindle form.

Besides these cells, we find in the neighborhood of the o. n. entrance and about the vessels piercing the sclera an abnormal quantity of spindle-shaped pigment cells.

Extensive alterations are found in the membrana Descem. Like Bowman's membrane, it is almost double its normal thickness, measuring at the edge of the chamber 0.0225 *mm.* and in the centre of the cornea 0.012 *mm.* Normal endothelial cells are not to be found.

Instead of the knotted appearance of the endothelial surface of the membrana Descem. seen on cross sections of the normal cornea, we find here only larger or smaller structureless wart-like prominences, often enclosing round or biscuit-shaped nuclei.

Surface preparations offer instructive appearances, though they are not the same in all portions of the membrane, approaching more nearly to the normal towards the centre of the cornea. Close to the anterior termination of the equatorial fibres of the iris, clusters spring up for the greater part of the most irregular form, often of large size, many isolated, but often confluent.

By coloring with hæmatoxyline they take a dull, bluish-gray color, and become prominent in the brighter surroundings. The smallest of these clusters have often the most fantastic shapes; one will appear knobbed like a cactus leaf, another approaches the form of a U, with lateral ectasias, another the form of a ring, etc. (See Fig. 3, Pl. xi.) These clusters have this in common, however, that they all contain vacuoles, and the number of these vacuoles does not depend on the size of the cluster. As many as ten vacuoles have been seen in one cluster. As a rule, they are round, exceptionally oval; they may be completely isolated, but very often two or three lie very close together, only separated by a thin partition wall, and now and then they open into each other.

They are of various sizes; many are not larger than a red blood corpuscle, but the majority have an average diameter of 0.015 *mm.* In a great many of these vacuoles there are nuclei.

In the tissue between the clusters we meet, besides nuclei and cells undergoing division, with large nuclei with nucleoli, as a rule oval, but also round, and only faintly colored with hæmatoxyline, and which are evidently endothelial nuclei.

These, however, are infinitely fewer in number than in the normal membrana Descem.; the cell contour is absolutely invisible, and the nucleus is much larger and longer than that of the normal endothelial cell.

If the preparation is now moved about two microscopic fields more toward the centre of the cornea, these clusters seem to disappear; in the field we see nothing more than a very fine granular mass with numerous vacuoles with the arrangement mentioned above, in which are embedded isolated nuclei deeply stained with hæmatoxyline.

Toward the more central portion of the cornea these clusters entirely disappear, and we meet with another entirely different picture.

We find large (0.024 *mm.*) round, finely granular structures in tolerably considerable numbers, on which lies an oval, brighter, and somewhat smaller nucleus. Many of these are crescentic, a fine outline sometimes completing the crescent to a circle; the crescent is often open and finely granulated. It would appear as though the protoplasm had escaped from the nucleus. In some of the round cells very small vacuoles are already apparent. The number of these formations does not reach that of the normal endothelial cells.

On cross sections the anterior surface of the iris is found to be covered with a thin granular amorphous layer. Embedded in this mass, but lying near the anterior surface, we find some lymphoid cells and some of those large cells with deeply-colored nuclei and coarse granular protoplasm, that we found in the vascular walls at the limbus, and which have been very properly called "wandering cells." The iris is infiltrated with them; in one preparation I counted from the iris angle to the pupillary border 110 of such cells. About the middle of the iris there is a mass of pigment patches of various sizes, partly round and partly elongated

in shape. In some the pigment is well preserved; in others it has disappeared, allowing the stained nucleus to be distinctly seen.

At those places where these pigment cells are most abundant, we also find the lymphoid cells in greater numbers. We meet with the same lymphoid infiltration again at the pupillary edge, the greater part of the cells resting upon the sphincter pupillæ. At the posterior edge of the uveal pigment we often find, in addition to the deep black pigment flakes, bright, yellowish-brown ones, which enclose pigment and a colored nucleus. Many pigment cells have become detached from the uveal border, and have lost a part or all of their pigment. At one side the uveal border is somewhat pushed forward.

The *lens* presents all the appearances of capsular cataract. These appearances are not most marked at the anterior pole, but we find especially outward and inward from the centre of the anterior pole two points with the characteristic alterations of capsular cataract, the transformation being into tissue very like connective tissue. The anterior capsule is wrinkled. Nowhere did I find normal capsular epithelium. Not only in the capsule and among its folds, but also on the inside of the capsule and in the tissue of the cataract, I found the most perfect pigment cells, though not in great numbers. As has already been mentioned, the capsular cataract consists of tolerably firm fibres running horizontally, and containing long, very small nuclei.

We find, moreover, enclosed in the cataract, remains of the lens-substance and numerous large and small oil globules, some of which are isolated and some united together in rows. In one preparation I found immediately behind the tightly stretched capsule an apparently coagulated fluid enclosed in large meshes. In the central equatorial part the normal concentric position of the lens fibres is apparent. Following these masses, which have a regular lamination, there are others consisting of large yellow, brilliant or small bluish glistening drops. These occupy spaces easily detected by the naked eye, some of the larger being about 4 *mm.* in length and 1 in breadth, as already mentioned

in the description of the macroscopic appearances. In those spaces we find enormously large cells, some measuring 0.0525 *mm.*, with nuclei of 0.01 *mm.* Some show a clearly defined outline, coarsely granular protoplasm and a distinct, well colored nucleus. In others the contour is not so sharp, their protoplasm is well disposed and their nuclei are normal; yet others have apparently degenerated into a granular mass, though a small, stained nucleus is still visible, but in many of the round granular clusters we do not find any such nuclei. Many of these cells appear to have undergone complete destruction, leaving behind a detritus, in which yet normal cells are embedded. A coarse network, originating from the edges of the cavities, serves as a support for the cells. On the posterior surface of the lens there is a membrane which, though occupying the position of the post. capsule, has not its structure. It is formed of tolerably firm fibres, which are arranged in a horizontal position, enclosing very small spindle-shaped nuclei and some round pigment cells.

The lens is held in its place through its connection with the zonular fibres. That they are really zonular fibres can hardly admit of a doubt, since the light fibres of the zonula with their sharp outlines cannot easily be confounded with any others. A remarkable feature about them is that near the place where they spread out into a membrane, they make a rotation about their axis. This rotation, moreover, is not the result of handling, as I have abundantly convinced myself. Forward, near their insertion into the cataract, the zonular fibres spread out in the form of a fan, and are held together by a frail, structureless membrane, which is united with the cataract. At the point where the zonula reaches to the pupillary edge, there is an invasion of numerous pigment cells in the fornix, and in part of long cells. Among these pigment cells also we find pigmentless cells and nuclei in all possible forms and degrees of division. On the delicate membrane, on which the zonula fibres are spread out, there are many cells with long processes. These cells lie together in groups, and form a most beautiful picture by the numerous anastomoses of their long processes.

They possess one, two or three nuclei, horseshoe-shaped, biscuit-shaped and spindle-shaped, and in some were seen small light-brown lumps of pigment. The form of the cell itself is very various: to many of the cells there adheres a small quantity of protoplasm. Lumps of protoplasm are also distributed free among the cells. Some of the cells have extremely long fine processes, which at places where the membrane is torn pass beyond the boundary into the free field of vision.

In front of the apex of the cone-like detached retina the vitreous membranes pass through the vitreous space to the opposite side. Some of the membranes arise from the inner surface of the ciliary body. These membranes consist for the most part of a series of rather firm, connective tissue fibres, with sharp outlines running parallel to each other, but in part also of finer threads. The fibres are often twisted into large strings, some of which unite in one place to form a knot frequently large enough to be recognized by the naked eye. In these knots are enclosed masses of pigment and a large number of nuclear elements for the most part in process of division.

In addition to these firm fibres, there are also fewer ones which, when they are completely isolated, can be followed for a very long distance. Here and there is to be seen a long spindle-shaped nucleus, and sometimes a well developed, spindle-shaped cell, and distributed irregularly all over the membrane are to be seen cells of all possible forms, sometimes collected together in groups. Very close to the origin of the membrane we find many very perfect round cells, with varying pigment contents. Many of these bear a vesicle, which is often larger than the cell itself. The flocculent mass, which quite entirely fills the space behind the vitreous membranes, consists of crumbling amorphous masses, in which I could detect neither cellular elements nor pigment.

The *cone* whose microscopic appearances have been already described, under the microscope showed itself to be nothing more nor less than a complete connective tissue degeneration of the retina. But we have no means of

knowing whether the cone consists essentially of a fold of detached retina, whose adjoining surfaces have been united, or whether in consequence of the strong traction of the vitreous membranes the degenerated retina is simply drawn out into a cone-shape.

The entire cone consists of a firm reticulated connective tissue framework. In and between the fibres a large number of oval spindle-shaped and round nuclei are irregularly distributed. In the retina, immediately adjoining the cone, a few granular layers are to be distinguished, but in the cone itself no definite arrangement of the nuclei can be made out.

Posteriorly the cone passes over gradually into the degenerated retinal tissue; anteriorly it continues for a short distance, and finally terminates somewhat abruptly (0.26 *mm.* in thickness). Over the whole cone there is stretched a wide structureless lamella, which shows a distinct fibrillation only at its innermost limit. As at the side of the cone, pointing forward, so also at the opposite side the anterior termination of the retina is pushed forward over the commencement of the cells of the pars. cil. ret. (Table xi, Fig. ii); its dimension is about 0.2 *mm.* These cells present a healthy appearance, with the exception of some finely granular and coarse pigment.

The retina, throughout its whole extent, from the optic nerve entrance to its ant. termination (inclusive of the cone), is in some parts united to the choroid, and in others separated from it by minute detachments.

The most marked alteration in the *optic nerve entrance* is a peculiarly formed mass of moderate size, lying on the outer edge of disk, in the layer of nerve fibres, just in front of the commencement of the choroid. The mass has the same consistency as the surrounding tissue, and cuts easily. The size is such as to bring about a displacement of the surrounding tissues (Pl. xii, Fig. v). The outer edge of the disk protrudes considerably into the vitreous chamber. On the outer side it descends rapidly towards the retina, but on the inner side it is elevated into a gently sloping prominence. The backward pressure of the mass is also very

evident. The outer edge of the choroid and the lamina cribrosa is pushed considerably backward, while the optic nerve fibres have been pressed in such a manner that the optic disk appears to stand obliquely inwards. The mass has a long diameter of about 0.5 *mm.*, and a width of 0.36 *mm.* The central part of the mass is colored a bluish-red by hæmatoxyline; the edges are not stained. Iodine reaction negative. The edges of the mass are not sharp but wavy, with round projections at the angles. With a magnifying power of 300 diameters, a distinct and elegant lamination is seen. The lamination is about a series of centres, almost every round projection being such a centre. In immediate relation to these larger laminated concretions, though not connected with them, are some smaller round concretions, likewise laminated. The growth of these masses seems to have been backward and inward. In other places regular clusters, with numerous berries, are seen connected with the larger concretions. The larger berries show a disposition to lamination; the smaller do not, but appear as drops of a dull glistening aspect of a light bluish color. Towards the lamina cribrosa we do not find any more of the concretions, but a large number of the stained drops mentioned above, of all possible sizes. The smallest scarcely measurable. The brightest of these drops are found along the first fibres of the lam. crib. The principal mass of the concretions is separated from the vitreous space by a very thin wall (0.05 *mm.*). A very inconsiderable increase in the connective tissue nuclei is observed about it. At the optic nerve entrance there is to be seen only a trace of the optic nerve fibres. The whole disk appears to be nothing more than a fine network of small connective-tissue fibres, stained deeply with carmine, with the ordinary scattering of nuclei. It is remarkable that the optic nerve fibres behind the lam. crib. show nothing abnormal in their arrangement, nor are they stained.

The vessels of the optic nerve entrance and their branches are well preserved; only the vascular sheaths are somewhat thickened, those of the arteries more, those of the veins less. The cavities are large; those of the arteries 0.01 *mm.*,

those of the veins 0.12 *mm.* The arteries contain but few red blood-corpuscles, the veins, on the other hand, are distended with them; at one place, where the filling is not so great in the vein, there is seen a large number of very small brilliant drops of myeline. At a circumscribed place at their passage through the lam. crib., there is a large collection of lymphoid cells about their walls.

The inner border of the retina and optic nerve is formed by two entirely distinct membranes, separated from each other by a layer of cells, the outer of which corresponds to the limitans int. From the internal surface of the retina a membrane of quite large size can be detached, which I took for the thickened hyaloid. Under the microscope it appeared that there were two membranes which I separated for a considerable extent. One of these membranes is structureless. A large part of its surface is covered with amorphous, granular coagulated masses of irregular shape. Diffused among those were found nuclei and cells in state of division, and often with processes. The second membrane is of an entirely different character, which, however, is not the same at all points. In some places we find fine sharply defined fibres running parallel to each other, which are most probably elastic fibres. A second layer of such fibres under this, and running in another direction, forms lozenge-shaped figures. In other places these lozenge-shaped figures are absent and we have only an irregular network of crossing fibres. This membrane very much resembles an *endothelial membrane*, in so far as in this network there are to be seen very large oval nuclei stained with hæmatoxyline, and very fine granular nuclei, with one or two very bright nucleoli. Here and there among these is to be seen a free space, and occasionally a vacuole. The largest of these nuclei have a length of 0.027 *mm.* and a breadth of 0.015 *mm.* Besides these nuclei we find about the same number of cells with finely granular protoplasm and deeply stained nuclei, either simple or in the act of division; also very large spindle-shaped and deeply stained nuclei, about many of which is a quantity of protoplasm. In those preparations taken from the equatorial region, we find a relatively large amount of pigment.

The *fibrous layer* of the retina in the ant. section of the globe is but little else than a roll of connective tissue fibres, scarcely an intact nerve fibre being seen. In the post. part, however, we often come acoss a relatively well-preserved fibrous layer.

In the degenerated fibrous layer we find small round deeply stained, and larger oval slightly stained nuclei. Well developed Müller's fibres are found at tolerably regular distances in the fibrous layer.

It is very seldom that a vessel is seen. When met with, its walls are, as a rule, considerably thickened; so much so, that in some instances the cavity is entirely obliterated. In the post. portion of the globe we do not find pigment anywhere about the vessels, and it is seldom met with in the fibrous layer; only in one place, where in the outer layer round pigment masses were seen scattered through the granular layer, do we find some round masses in the fibrous layer. These, however, I do not regard as pigment cells. They are round, it is true, but they vary in size, and the pigment is much brighter than that of the retinal epithelial cells. It is only in more peripheral portions of the retina, where there is a greater quantity of pigment in the outer layers, that we find pigment in the fibrous layer, often in long lines running horizontally with the connective tissue fibres. I do not think that they are always grouped about the course of a vessel, at least it has not often happened to me to find the trace of a vessel. The pigment is not necessarily enclosed in cells, but may be found in the fibrous layer in an amorphous condition. This amorphous pigment is often disposed in so thin a layer that the nucleus of a casual pigment cell can be seen.

The *ganglionic layer* is at the most posterior portion of the globe, for some distance presented as an individual layer. We have then every reason to expect to find in the outer layers, a remnant of an outer granular layer, or, at any rate, not so high a degree of wasting as in those places where the ganglion cells are completely wanting.

The preserved ganglion cells show a very brilliant appearance. From the equator beyond no ganglion cells are

to be found. At the equatorial portion of the retina we again come across the pigment in the ganglionic layer, which is collected in the arches, as a rule, in large round masses.

The inner molecular layer is easily distinguished in the posterior portion of the globe as a separate layer, and even beyond the equator traces of it are to be made out. No trace of its very characteristic granular appearance, however, is to be found. It is seen to be composed of two layers, the inner consisting of a fine, delicate, spongy tissue, the outer of some fibres running horizontally and close together, which are entwined among the supporting fibres passing upward.

The inner granular layer is the best preserved of all the layers of the retina from the optic nerve entrance to the ant. limit of the retina. In the immediate vicinity of the optic disk the retina is adherent to the choroid for some considerable distance. At these points the radial fibres are stretched, and, as a consequence, the granular layer is widened and the granules more thinly distributed.

In other places the layer has a normal appearance. When there is no adhesion to the choroid the inner granular layer is bounded by what appears to be a kind of limiting membrane.

There does not exist any outer molecular and granular layer in the strict sense of the word; only at a few places where the ganglion cells are relatively well preserved is there to be found a trace of an outer granular layer.

In by far the largest number of places we find externally to the inner granular layer only a reticulated connective tissue framework, with large, irregular meshes and nuclei at the points of crossing and between the single fibres. Outside this network, which in the post. portion is 0.075 *mm.* wide, is bounded by a sharply-defined limitans ext.

No trace whatever is to be found of the layer of rods and cones.

The above described, if I may so call it, normal condition of the inner granular layer, of the reticulated connective tissue framework and the limitans ext., was modified in many and very interesting ways.

As has been mentioned, the retina on both sides of the optic disk was adherent to the choroid. At the point of adhesion there is no trace of the normal lamella of the choroid: not a trace of the retinal epithelium, no lam. vit., no vascular cavities in the chorio-capillaris, and only here and there in the deep layer the cross-section of a vessel, evidently belonging to the layer of smaller vessels. For the first time we come across full vessels in the pigment layer, some of which are thickly surrounded with lymphoid cells. It is impossible to find any separation between the retina and choroid at the places of adhesion, except in so far as the radial fibres run vertically and are bent back on themselves at the points of adhesion, whilst the individual fibres of the choroid run horizontally. It is not possible to discern at this point any limit. ext. Following these points of adhesion there are patches of microscopical retinal detachments of very considerable extent, and following these are patches of greater or less extent of adhesion, followed again by those of detachment, and so on up to the ant. termination of the retina. The space between the detached retina and the choroid is filled either with a completely amorphous granular mass, without any cellular elements, except, perhaps, occasionally a retinal epithelial cell, or there may be a very fine network of fibres.

In other places the fibres become firmer, and form a coarse network. The mass lying between the detached retina and choroid is connected on the one hand with the limitans ext. and on the other with the retinal epithelium. An influence has been at work on these external epithelia, which is very important to notice for a clear understanding of their appearance.

The *pigment of the retinal epithelium* at the localities of the minute external detachments is either completely absent or in a condition of profound atrophy.

At the inner edge of the o. d., the proliferation of pigment has caused small elevations. The conical offshoots of the epithelial cells between the cones and rods toward the lim. ext. are very marked and numerous, and they penetrate through this into the retina. The limitans is stretch-

ed, in many places torn, and the radial fibres are hypertrophied. Adjacent cones are adherent. At the places of adhesion the framework fibres are slightly stretched through the whole thickness of the retina.

At the equatorial and peripheral parts the outer retinal layers are studded with large, richly pigmented cones. These cones often attain to the length of 1 *mm.* We also find pigment in the outer layer, where no direct connection with the retinal pigment is demonstrable. The pigment is often in the form of a broad stripe, especially when it lies along the radial fibres in the fibrous layer, or it rises like a bulb in the granular layer. The pigment masses are often of considerable size; they occupy the otherwise atrophic retinal tissue completely; many enclose a rather bright, light-reddish (hæmatoxyline) mass, which is apparently without any structure, but which resembles the glands of the vitreous layer.

In my description of the macroscopic appearances, I mentioned a band 6 *mm.* long passing forward from the equator, which apparently ran the course of a retinal vessel, but which in fact was adherent to the choroid. A microscopical examination shows that a deep furrow is here made in the retina, extending through nearly its entire thickness, by very large black pigment masses, elevated high above the level of the retinal epithelium. The masses are bordered with intensely black pigment. Towards the summit, however, they often separate from each other, and form larger or smaller islets, in which are found peculiar bright glandular bodies, in many of which are to be seen the nuclei of the non-pigmented epithelial cells. For a less extent of surface we find these conditions in many other places.

I found red blood-corpuscles, not only in the amorphous mass between the choroid and retina, but also in the outer layer of the latter.

The retina in general is somewhat thicker than normal, even making allowance for the lim. int. and the hyaloid. The retina reached its highest degree of atrophy at the macula lutea, measuring at this point 0.024 *mm.*, and having the appearance of a fine striped membrane with some cells.

There is no trace of the lam. vit. nor the chorio-capillaris, but we find in their place some large connective-tissue meshes, and immediately on this the layer of pigmented lamellæ with its large vessels. The choroid and retina together at this place measure 0.15 *mm.*

The pathological alterations in the retinal epithelium begin behind the ora serrata and continue up to the optic nerve entrance. The pigment is completely atrophic. There are large patches where not a molecule of pigment is to be seen in the epithelial cells, while the cells themselves are well preserved as evidenced by the preservation of the nucleus. At many places the polygonal contour is made out, but with no great distinctness. In the midst of the atrophic retinal epithelium we come across large detached polygons of pigment, on large round patches of round or oval pigmented epithelial cells. These patches stand out quite prominently sometimes, and are often of a strikingly honeycombed appearance.

In the description of the macroscopical appearances, we mentioned having met with relatively large rings of pigment with a bright centre, which, however, were not equally pigmented all around. From the inner margin of the ring there are offshoots lying upon a homogeneous membrane, which occupies the space formed by the ring. Below this membrane there lies a sharply-defined large patch of lymphoid cells with atrophic stroma cells. We also find places analogous to these where the above-mentioned membrane is absent, and the lymphoid collection, when it is present, is perfectly isolated. The choroid is thinned so that it measures at the equator only 0.04 *mm.* The lam. vit. is for the most part well preserved, and is missing only at those places where the adhesions are extensive; it is nowhere found thickened. Of a chorio-capillaris we find, as a rule, no trace. Even the layer of smaller vessels is in places lacking, so that immediately following the epithelial layer we have the pigmented lamella, with its larger vessels filled with red blood corpuscles.

The supra-choroidea is represented by a broad, strongly pigmented membrane. Where there is no adhesion, the

lam. vit. is most distinct. The atrophy of the choroid is less pronounced towards the post. pole of the eye.

We will now proceed to a description of the surface preparations, which first give us some explanation of the true nature of the choroidal process. The most striking condition is a very peculiar form of vascular degeneration. which is most marked in the vessels of the chorio-capillaris and the smaller arteries and veins, but which is also apparent in the larger vessels. This vascular degeneration affects the choroid throughout its whole extent (Pl. xi, Fig. iv). When we look at one of the smaller vessels filled with red blood corpuscles, we see in the midst of these, or on the edge of the vessel, as a rule, round, seldom oval, bright vesicles. Two or more such vesicles may be close together, but there is always visible a line of separation between them. At first glance these structures would be taken for true vesicles, perhaps for inflated red or white blood corpuscles. But if we take a vessel and follow it out, the thickly studded red blood corpuscles suddenly cease, the blood current suddenly stops. Nevertheless we yet see the round vesicles, if I may be allowed the expression, either singly or collected together. On this account we are in doubt as to whether they are true vesicles, and become satisfied that they are not when we come to a rupture of one of the larger vessels. It appears as if there was a hollow hyaline cylinder in view rather than a vessel, out of whose sides round holes of indefinite number and size had been punched. If the fracture of such a vessel goes through one of these holes, then of course the circle is open at one side (Fig. iv).

Around the cylinder, and at a short distance from it, we find a very fine membrane, in which oblong nuclei are embedded. The layers of the choroid in which the vascular degeneration has made most progress, present a very peculiar appearance.

Of the chorio-capillaris, in the ordinary sense of the word, there is scarcely anything remaining. Only in very limited areas could I isolate it, and here and there it presented itself at a rent in the preparation above the atrophic retinal

epithelium. I would also remark that at some of these places I have met with the endothelial layer with pale large oval nuclei, described by Sattler. Instead of the ramifications of the normal capillaris, we see only a light bluish, apparently homogeneous stripe, with its characteristic holes; a circle is often of such a size that to the right and left only a very small edge remains; here and there is to be seen what is taken for a red blood corpuscle; in one or more of the round openings lies a lymphoid cell. Between the edge of such a vessel and the interstitium is an immeasurable cleft. The capillary nuclei are clearly distinguishable. The capillary interstices appear in part finely granular, in part finely striated. We find in them, besides the large oval nuclei, here and there also a wandering cell in a free space.

We will now examine the first pigmented layer somewhat more closely.

Such a place near the ora serrata is figured in Pl. xi, Fig. 4.

The vessels exhibit the above described degeneration in a most characteristic manner. The blood contained in the vessel, instead of being in a continuous column, is frequently collected here and there into large bulbs with irregular interstices. The vascular walls are often very difficult to make out, sometimes the nuclei only showing these places, and we are often left in doubt whether we have to do with a hemorrhage or whether the blood is surrounded by a membrane. And this doubt is increased by the existence of genuine hemorrhages, though they are not so extensive as those we find in certain affections of the retina. We never find large patches, but only a certain number of red blood corpuscles in the interstitial tissue between the stroma cells. In addition to these extravasated red blood corpuscles we find, principally along the nuclei which mark the vascular wall, larger and smaller collections of bright, yellowish-brown, coarsely granular pigment, evidently of hemorrhagic origin. The stroma cells lying in such tissue islands have in part the normal pigment contents, but others are so sparingly pigmented and the pigment is so finely granular that the stroma cells are made out with dif-

ficulty, and so much the more as the processes are either broken off or atrophic. We find wandering cells again along the vessels, and in all the preserved layers of the choroid; in the supra-choroidea in the very smallest number. They seem to me to be the offspring of the stroma cells.

Aside from the hemorrhages into the interstitial tissue, we find here and there in the ant. portion collections of lymphoid cells, and among them again lumps of pigment evidently of hæmatic origin. The tissue between two vessels exhibits a very fine striation, in which are found only nuclei and lymphoid cells.

There is no increase in the number of red blood corpuscles inside the vessels. We find in the vessels bright drops of myeline, as a rule collected together in large patches.

We find considerably less alteration in the layer of large vessels with their pigmented lamellæ.

In the ant. section of the globe we met with collections of lymphoid cells, which increase in size and number toward the equator. The largest of these are readily distinguished by the naked eye, and measure 0.72 *mm.* in length and 0.36 *mm.* in breadth. I have found in some preparations large drops of myeline between the stroma cells. No hemorrhages in the layer of large vessels were observed.

In the supra-choroidea no alterations worthy of note were found.

In the corpus ciliare the longitudinal muscular fibres were found preserved, the circular ones atrophied. While in the pigmented portion of the corpus ciliare itself only trivial alterations were found, the epithelial cells show quite pronounced alterations. Many appear vitreous and swollen.

The epithelial cells of the corp. ciliare proper, but especially the cells of the pars plana corp. cil., adhere together and jut out like tumors, forming long cylinders, which are strikingly like the cylinders of certain new formations. Along these cylinders we again find pigment in large flakes. In speaking of the vitreous membranes, I have already mentioned that some of these originate from the inner surface of the pars plana corp. cil. and the processus cil-

iares. The structure of this membrane is the same, only the contents of the pigment cells are somewhat richer.

It is seldom that a simple luxation of the lens into the vitreous chamber brings about such a series of pathologico-anatomical alterations as in the case just described, in which the alterations induced by the luxation are of much greater importance than the luxation itself. The most interesting conditions are the choroiditis and the connective tissue degeneration of the retina with infiltration of pigment. That the choroiditis began as a choroiditis disseminata is evident from the large collections of lymphoid cells. Of special importance is the peculiar vascular degneration which chiefly affects the chorio-capillaris and the larger of the small vessels. The degeneration can hardly be looked upon as primary, but must be the consequence of the chronic choroiditis and is probably effected by pressure on the part of the large collections of lymphoid cells. In our case we have not to do with the well known degeration of the vessels of the choroid as described by Pagenstecher, Müller, Schweigger and Rudnew, in which the calibre of the vessel was completly filled by the hyaline mass. I look upon the condition in our case as a *degeneration with vacuole-formation*, and assume as the essential cause of this a peculiar alteration of the vascular endothelium. Whilst we recognize in the normal chorio-capillaris the walls of the fine vessels only by the sharp outline with the capillary nucleus, we see before us here a tube which is colored by hæmotoxyline bluish gray, by aniline reddish or not at all, and in which iodine produces no reaction.

By the formation of the vacuoles is it clear how so large a space of the chorio-capillaris has completely disappeared. By the rigidity of the parietes and the formation of the vacuoles the continuity of the circulatory blood current is broken up and the emigration is rendered easier. We never meet with large hemorrhagic foci, but repeatedly with smaller extravasations. The new-formation of pigment is as yet a mystery, since it stands in no relation whatever to the atrophy of the pigment in the epihelial cells. Do we have in these collections of pigment a source for the new-form-

ation of pigment? What becomes of the blood contained in the chorio-capillaris which has disappeared? Are we not to look to the coloring matter of the blood as the origin of the pigment?

The rods and cones, the outer granules and the ganglion cells are wanting; the inner granules are rarefied; the layer of fibres is atrophic. Naturally we find all these appearances only at those places where the process has been the most advanced. In proportion as the nervous elements disappear the connective tissue increases in abundance. As all the connective tissue is hypertrophied, the walls of the vessels must participate in the process, they become sclerosed, and once the process is begun in a vessel, it readily extends to the surrounding parts. As would be expected, the frame-work is the most hypertrophied. The frame-work of Müller was converted into genuine trabecles. Instead of the intergranular layer and the outer granules, we find a coarsely reticulated connective tissue with nuclei at the points of intersection.

We have now explained two important conditions by the atrophy of the chorio-capillaris: the atrophy of the nervous and the hypertrophy of the connective tissue elements. There yet remains another important condition to explain, namely, the pigmentary infiltration. For this I also hold the atrophy of the chorio-capillaris responsible, though in a more indirect manner. I consider the adhesion of the retina with the choroid to be a purely mechanical process, brought about by the retraction of the connective tissue. From a study of my preparations I cannot accept the explanation that the radial fibres enlarge independently (Bolling A. Pope), break through the retinal epithelium and surrounding the retinal epithelium form the passageway for its entrance into the retina. I hold this to be an incorrect interpretation of the appearances. In some few places I saw the radial fibres considerably increased in length and running horizontally, but in such cases there was always an extensive adhesion towards which the radial fibres were drawn and, of course, were partially horizontal.

The traction of the retracting connective tissue draws the retinal epithelium into larger cones.

Have we here to do with a typical retinit. pigment.? I answer, unqualifiedly, yes. Processes which, with the exception of a few unimportant particulars, run the same characteristic course, must have a common cause. This common cause I find in the atrophy of the chorio-capillaris, an opinion which Knies has already advanced as far as regards the typical ret. pig. (*Archives O. and O.*, vii, p. 349, etc.).

It is true that the examinations of typical ret. pig. up to this time are not entirely favorable to this view, since only in a few cases (for example, Landolt, *Gräfe's Archiv* xviii, 1, p. 325) is any mention made of alterations in the chorio-capillaris. I cannot, however, dismiss the thought from my mind that it is in this case as in many others. One does not find what one does not look for. Everything points to the fact, especially insisted on by Schweigger (*Gräfe's Archiv*, v, 1, p. 109), that the percipient elements of the retina are the first to suffer, and of which the first symptoms, torpor retinæ, seems to be conclusive proof.

Now, if we can find no independent disease of the rods and cones, (and we have yet no facts pointing to this), and if we cannot accept Alt's idea (these ARCHIVES, viii, p. 107) of a hyperplasia of the pigment cells as the primary process, the destruction of the rods and cones being due to mechanical compression from these cells (for the simple reason that we often find the rods and cones destroyed at places where there is no pigment emigration nor pigment hyperplasia), then we must accept the explanation that the percipient elements are the ones primarily affected, and through alterations in the chorio-capillaris.

The laminated concretion at the outer edge of the papilla is deserving of a detailed consideration, on account of the prominence it has assumed in modern ophthalmological literature through the very rare case of Nieden, in which it was observed ophthalmoscopically (*Centralbl. f. prak. Augenheilk.*, Jan., 1878, and supplement to Aug. number,

p. xix, and also in supplement—Proceedings of the Heidelberg Congress—to Zehender's *Monatsbl.*, 1878, p. 174).

Nieden contends that this ophthalmoscopic appearance, limited to the optic nerve, had up to that time been observed by him* alone, though colloid formations in the choroid had been observed by Liebreich, and Nagel. H. Müller and Iwanoff have given anatomo-pathological descriptions of laminated concretions of the optic nerve. Müller found them in both eyes of a man 75 years of age, who was myopic, and had atrophy of the nerves and a typical spotted retina. They occupied the place of the lam. crib. He expressed no opinion as to their derivation; all he said was that, microscopically, they were very like the colloid bodies of the choroid. Iwanoff had, up to 1868 (*Klin. Monatsbl.*, vi, p. 426), seen these structures six times. Twice in the two eyes of the same individual. In the other four cases he had only one eye at his disposal. Of the first two cases, the vision in one during life was intact, whilst in the other, a lunatic, there was total amaurosis. The remaining eyes were enucleated on account of injuries or foreign bodies. Iwanoff is of the opinion that these structures are probably nothing more than colloid deposits on the vitreous layer of the choroid, from the edge of which they are pushed into the optic nerve. This opinion of Iwanoff seems to have been generally adopted; at least Leber and Wecker have incorporated it into their works (*Handbuch der gesammt. Augenheilk.*, Leber, B. v, 2, p. 910, and Weeker, B. iv, 2, p. 641). Nieden also, in the explanation of the ophthalmoscopic appearances of his case, in which these structures were found in both eyes as a complication of ret. pig., accepts this view. I must positively dissent from it. I have made a large number of microscopical sections, and I have never yet found any connection whatever between these concretions and the choroid. If any such connection had previously existed, the concretions would have separated from it and been found as isolated bodies in the optic nerve. From the communication of Iwanoff it is not perfectly clear

* In the meantime Jany reported a similar case in the June number of the *Centralbl. f. prak. Augenheilk.*

that the concretions were in direct connection with the lam. vit. His expression that the concretions extended in the optic nerve up to the lam. vit. of the choroid, might mean that the concretions originating in that portion of the optic nerve had, by their growth, extended up to the lam. vit. In my case it would be impossible to assume that the lam. vit. was the point of origin of the growths, for on transverse sections in the immediate vicinity of the papilla, at the place of adhesion between the choroid and retina, I could find no trace of a lam. vit.; it had completely disappeared.

It might be supposed that the concretions spring from that side where the lam. vit. is still preserved, if the numerous large and small drops which are partly isolated and partly grouped together, and reach backward and inward up to the lam. crib, did not show a quite pronounced lamination, proving that we have here these concretions in process of formation. I once came across these concretions in an eye with retinal detachment, which, however, in spite of this, took on acute glaucomatous symptoms. A very large laminated concretion, with many smaller in its immediate vicinity, was found lying in the pedicle of the detachment, about 1 *mm.* from the choroidal ring, in the layer of fibres which had undergone connective-tissue degeneration. Another was found likewise in the layer of fibres about 8 *mm.* in front of this, at the point where the folds of the detached retina separate in the form of a flower.

We can certainly not be dealing, in the present case, with a growth from the lam. vit.

The method of growth, likewise, according to my mind, is against its origin from the lam. vit. Nieden has followed their growth with the ophthalmoscope, and describes it as follows: "It is evident that it is a pure granulation structure which springs, like a cauliflower, from the edge of the optic nerve, and consists of numerous extremely fine granulomas, the smallest of which have the appearance of brilliant drops of oil." This description tallies exactly with the anatomico-pathological appearance in my case, which I have drawn on stone as true to nature as was possible (Fig v).

If, then, they do not spring from the lam. vit., what is their true nature? The most plausible answer is that they are amyloid concretions. As with others, so also with me, was the iodine reaction negative. That, however, is no proof that they are not allied in their nature to amyloid bodies. We know that besides structures which give the promptest reaction, there are others which are negative. I would here call to mind the fact that laminated concretions are always found in the layer of nerve fibres of the lam. crib., which would seem to show that we probably had in these structures something analogous to those found in pathological conditions of the central nervous system, where the connective tissue is increased at the expense of the medullary substance. As our knowledge of the origin of these structures is limited, so we are unable to say anything with definiteness about the concretions in the layer of fibres. With a proper degenerative process of cellular structures, we have in all probability nothing to do in this case. The structures are, perhaps, formed from myeline, though they may not be directly derived from it. A circumstance which seems to point to this is, that we find in the vessels a remarkably large number of drops of myeline, and that we find them the smallest at the lam. crib. But as we said we know nothing positive about their origin, I can only state that they do not come from the lam. vit.

The case also offers a not unimportant contribution to the pathology of the crystalline lens. That a luxation of the lens into the ant. portion of the vitreous was the first step in the train of processes which followed, was the alarm signal for the outburst of so many pathological appearances, is proved, in addition to the anamnesis, objectively by the existence of membranes in the vitreous humor. We have, however, to deal with a double luxation, first into the vitreous, and afterwards into the anterior chamber.

The dislocated cataract has brought about the same appearances in the anterior chamber as it did in the anterior portion of the vitreous humor. As a consequence of the irritation produced by the contact of the hinder wall of the cataract with the anterior surface of the iris, there is

formed on the surface of contact a fibrous-like exudation containing lymphoid cells that had wandered in from the iris. As a consequence of the transformation of these formative cells into spindle-shaped cells and finally into connective tissue fibres there are formed connecting filaments between the iris and the cataract.

Here the pigment cells have participated in the formation of these connecting filaments to even a greater extent than in the vitreous humor, except those which have continued their wanderings along the fibres. This wandering of the pigment cells is a very interesting phenomenon. As a rule, the pigment cells prefer to follow paths already formed. In one of the preparations from the foregoing case, the number of pigment cells along the course of one of the vessels of the sclera was most striking. And we find in retin. pigment. the most pigment along the vessels, because it is in the sheaths of these that they find the easiest path for emigration. Many pigment cells lose their pigment in their wanderings, while others preserve it intact. How rapidly the cells of the retinal epithelium lose their pigment when they are in a detached retina and subject to the action of the fluids, and what extensive tours our pigment cells make with their pigment contents intact, when they have connective tissue as a base on which to continue their wanderings, and are not simply washed about. The pigment molecules appear also to congregate by this possibility of active movement. When a good many meet in their wanderings, they associate themselves in groups and form round patches making a kind of pigment epithelium. These cells then come to a rest. We see this appearance in a very pronounced manner in the membrane of the vitreous humor above mentioned, where they find a firm basis on the crossing-points of the connective tissue fibres.

Explanation of Plates X, XI, XII.

Plate X. Figure 1. Anterior portion of the globe, 4:1.

Dislocation of the shrunken cataract into the anterior chamber with the connecting fibres. (The fine membranes are not represented.) Behind the pupillary space, the membranes of the

vitreous, which on the right side are attached to the retinal cone; this cone is continued over towards the left side as a prominent ridge. The black stripe which goes from about the middle of the cut surface forwards and to the right marks the place where the large cones have extended into the retina.

Plate X. Figure 2. (Seibert, Oc. I. Obj. V.)

Ora serrata, choroid and retina. The retina is completely transformed into connective tissue and drawn forward. Adhesion with some cells of the pars ciliaris; in the space between the anterior termination of the retina and the cells of the pars ciliaris there is a large pigment cone. Microscopical detachments of the retina, in some of which are found granular masses, and in others fine fibres; epithelium transformed into small cones; a larger cone drawn into the retina; in its interior are granular masses and larger fibres.

Plate XI. Figure 3. (Seibert, Oc. I. Obj. V.) Alterations in the endothelial layer of the membrane of Descemet.

Plate XI. Figure 4. (Seibert, Oc. I. Obj. V.)

Vascular degeneration with the formation of vacuoles; upward and to the right a small collection of lymphoid cells; to the left and below and between the two vessels, atrophic stroma cells, some emigrated red blood corpuscles, pigment of blood origin, some wandering cells.

Plate XII. Figure 5. (Seibert, Oc. I. Obj. III.)

Laminated concretions on the outer edge of the papilla; oblique position of the disk; origin of choroid on right side deeper than on the left.

OPHTHALMOSCOPIC OBSERVATIONS UPON THE REFRACTION OF THE EYES OF NEWLY-BORN CHILDREN.*

By EDWARD T. ELY, M.D.

DURING the past year I have made some ophthalmoscopic examinations to ascertain the refraction of the eyes of newly-born children, and I will venture to publish the results of my work, meagre as they are.

I have examined 111 children, of whom only six were over two months old. Among this number I have been able to make a satisfactory examination of 154 eyes in 90 subjects. Seventy-nine children were examined under the following conditions;

(1.) The eyes were put under the influence of a single instillation of a solution of atropine, containing two grains to the ounce, and a small dose of paregoric was given for its quieting effect.

(2.) The accommodation of my own eye was completely paralyzed by atropine.

(3.) The child was held erect by an assistant, and its lids were gently held apart, when necessary, by the thumb and forefinger of one of my hands.

(4.) The examination was made in the ordinary dark room, with moderate illumination from artificial light, by a Loring ophthalmoscope and in the upright image.

Following this method, I recorded the refraction of 105 eyes. For the sake of convenience, only 100 of these have been used in tabulating the results.

* This paper was received November 2, '79.—*Editor.*

I.

SEX.	EYES.	REFRACTION.		
		EMMETROPIC.	MYOPIC.	HYPERMETROPIC.
Males,	48	9	6	33
Females,	52	8	5	39
Total.	100	17	11	72

II.

AGE.	EYES.	EMMETROPIC.	MYOPIC.	HYPERMETROPIC.
One week or less, .	51	11	4	36
1–2 weeks, . .	28	2	7	19
2–3 " . .	9	2		7
3–4 " . .	4	2		2
4–5 " . .	3			3
5–6 " . .	1			1
6–7 " . .	2			2
8 " . .	2			2
Total, . .	100	17	11	72

The nationality of the mothers could be obtained in thirty-nine cases:—

III.

CHILDREN.	NATIONALITY OF MOTHERS.	EYES.	EMMETROPIC.	MYOPIC.	HYPERMETROPIC.
23	Irish . .	38	6	5	27
9	American .	15	1	4	10
3	German .	5		2	3
2	English .	4			4
1	Bohemian .	1			1
1	African .	1			1
39		64	7	11	46

The refraction of the mothers' eyes could be obtained in ten cases only.

IV.

	MOTHERS.		CHILDREN.	
	RIGHT EYE.	LEFT EYE.	RIGHT EYE.	LEFT EYE.
1	H	H	H	H
2	H	H	H H	H H } Twins.
3	H	H	H	H
4	M	M	E	E
5	H	H	H	H
6	H	H	M	M
7	E	E	H	H
8	M$\frac{1}{4}$	Not seen on account of syncope.	H	Not seen on account of conjunctivitis.
9	M	M	H	
10	H	H	H	H

Of the hundred eyes, as will be seen from Table I, 17 per cent. were emmetropic, 11 per cent. myopic, and 72 per cent. hypermetropic. A calculation based upon the number of children gives about the same result.

Forty-nine eyes in twenty-seven subjects were examined in a somewhat different way. The pupils were dilated by a single drop of a very weak solution of atropine, containing one grain to the pint. No paregoric was given. No atropine was used in my own eyes. Conditions (3) and (4) were the same as before.

V.

SEX.	EYES.	REFRACTION.		
		EMMETROPIC.	MYOPIC.	HYPERMETROPIC.
Males,	19	2	9	8
Females,	30	2	7	21
Total.	49	4	16	29

VI.

AGE.	EYES.	EMMETROPIC.	MYOPIC.	HYPERMETROPIC.
1 week or less, .	13		3	10
1–2 weeks, . .	20	2	7	11
2–3 " . .	8	2	2	4
3–4 " . .	2		2	
4–5 " . .	1		1	
5–6 " . .	4			4
7–8 " . .	1		1	
Total, . .	49	4	16	29

VII.

CHILDREN.	NATIONALITY OF MOTHERS.	EYES.	EMMETROPIC.	MYOPIC.	HYPERMETROPIC.
10	Irish . .	17		6	11
7	American .	13		7	6
3	German .	6			6
2	English .	4			4
2	Scotch .	4		2 .	2
2	Swede .	4	2		2
1	African .	1		1	
27		49	2	16	31

The following table includes all the cases observed.

VIII.

SEX.	EYES.	EMMETROPIC.	MYOPIC.	HYPERMETROPIC.
Males,	72	11	15	46
Females,	82	10	12	60
Total.	154	21	27	106

Emmetropic about 14 per cent.
Myopic " 18 "
Hypermetropic " 69 "

The appearances of the fundus in these eyes were similar to those seen in adults. There were the same deposits of pigment, and the same choroidal crescents and rings about the edge of the optic disc; there were variations in the

color and in the shape of the disc, and in the form and position of its physiological excavation; and there were irregularities of choroidal pigmentation. A difference of refraction between the two eyes was not noticed in any case. I believe these observations agree with those of Von Jaeger, mentioned below.

As a whole, the disc and fundus were much lighter than in adults. The crescents about the disc were found indiscriminately in Emmetropia, Myopia and Hypermetropia. The appearances of the fundus in the myopic eyes could not be seen to differ from those of the others.

In case No. 77 the optic disc of the right eye presented a large excavation, of grayish hue, simulating the appearance of advanced atrophy in the adult. The margin of the excavation, at one part, appeared very abrupt, as in glaucoma. The disc of the other eye looked normal.

In case No. 63 there was marked neuro-retinitis in the right eye. The history of this case was as follows: The child was left upon the steps of the Foundling Asylum one cold night in January. Having been left at the wrong door, it was not discovered until two o'clock in the morning. It was then so chilled that it was revived only with difficulty. It had not been washed and was evidently only a few hours old. It was seen by me in the afternoon of the same day. It was a small baby, of "senile" appearance; otherwise, the general examination showed nothing abnormal. The ophthalmoscope revealed marked evidences of neuro-retinitis in the right eye. The optic disc and surrounding retina were much swollen; the retinal veins enlarged and tortuous. Scattered over the fundus were some small hemorrhages, and a few round, yellowish spots, looking like exudations. There was slight divergence of the optic axes.

The next day, January 28th, the appearance of the right eye was about the same. The fundus of the left eye looked cloudy, as if the same process were begining there. The eyes were examined by Dr. Loring and Dr. Roosa, who agreed with my diagnosis.

January 29th, there was no special change in the appear-

ance of the eyes. The baby was nursing well and looked better.

February 18th the eyes seemed about normal. There was still slight divergence. The general condition was much improved.

Many efforts were made to obtain a specimen of this child's urine for analysis, but without success. Eleven months later, I asked permission to examine the condition of his eyes again, and was told that he had died of gastro-intestinal catarrh during the hot weather. I know of no other case on record where neuro-retinitis has been observed in so young a child.

Although somewhat irrelevant to the subject it may be stated here that the iris in every baby seen by me, including one negro, was of a bluish color. Dr. V. G. Culpepper has been kind enough to make more extended observations for me upon this point, in the Maternity Service of Charity Hospital. In fifty newly-born children noted by him, there was only one dark iris. This occurred in a negro. One of the nurses at the Maternity Hospital assured me that her attention had often been directed to this subject, and that in over 1,000 confinements she had seen only one child with dark irides. The mother of this child, she said, had very dark hair, eyes and skin. I think that all the text-books state that the eyes of all newly-born children are blue. This is undoubtedly the rule, but it does not seem to be invariable.

Many of my cases were very young, and it may be of some interest to consider these apart from the others. Forty-four children (yielding 64 eyes) were seen during the first week of life:

One child, a female, was examined 30 *minutes* after birth. The refraction of both eyes was hypermetropic; there was a black line of pigment about the discs; all parts of the eyes look well developed. The mother was hypermetropic in both eyes.

One male, seen 2½ hours after birth, was hypermetropic in both eyes.

One male, seen 5½ hours after birth, was markedly hypermetropic in both eyes.

One female, seen 6 hours after birth. Both eyes hypermetropic; optic discs very white; retinal vessels larger than usual.

Two males were seen 20 hours after birth. One had a hypermetropia of $\frac{1}{12}$ in each eye. The other was hypermetropic in the right eye; the left was not seen satisfactorily.

IX.

CHILDREN	EXAMINED ON	EYES.	REFRACTION.					
			EMMETROPIC.		MYOPIC.		HYPERMETROPIC.	
			Under the strong solution of atropine.	Under the weak solution.	Under the strong solution.	Under the weak solution.	Under the strong solution.	Under the weak solution.
9	1st day.	14	1		1		10	2
5	2d day.	6	2				4	
3	3d day.	4	2			1	1	
8	4th day.	8	2				4	2
7	5th day.	8	2		1		3	2
2	6th day.	4				2		2
10	7th day.	20	2		2		14	2
Total, 44		64	11		4	3	36	10

According to Table IX, all three of the principal refractive states of the eye exist on the first day of life.

Certain details regarding the examinations may be interesting to some readers. Aside from the trouble of obtaining the subjects, the difficulties were found to be considerable. Most of the infants were very restless and disposed to cry. Even when the child remained quiet enough, there was often constant oscillation or rolling upward of the eyeballs when the light was thrown upon them. In some cases it was easy to get a general view of the fundus where it was impossible to get such a succession of views of some particular object as is required for measuring refraction. Or, the refraction could be ascertained in a general way, but the child would begin to cry, or become very restless, before an ex-

act measurement could be made. This happened so often that the degrees of hypermetropia and myopia have been omitted from the tables altogether, even where they were determined. I should not think it possible to determine a myopia or hypermetropia of less than $\frac{1}{48}$ in these cases. I freely admit that I did not feel competent to do so.

Sometimes, success was prevented by mucus on the cornea, from catarrhal inflammations of the conjunctiva; in several cases, by an opacity of the cornea, caused by a very rapid drying of its epithelium as soon as the lids had been held apart for a few seconds. Any working back or forth of the lids to moisten the cornea, or to wipe mucus from it, was very apt to make the child cry. Anaesthesia from chloroform-inhalations was tried, but it was followed by such a rolling upward of the eyeballs as to prevent examination. A small speculum to hold the lids apart, and a fixation-forceps to steady the eyeball, were also tried. These instruments produced so much crying, congestion of the eye, and spasmodic pressure from the lids, that I abandoned them. After trying many expedients, the best way that I found for keeping the child quiet was to give it a small dose of paregoric, as already mentioned, and to allow it to suck the assistant's finger, or a bit of rag, moistened with syrup. It is much easier to hold the child quiet when a towel is wrapped around its body so as to confine the legs and arms. When it was necessary to hold the lids apart, my fingers served better than anything else. When the eye rolled out of view, a little pressure against it through the lid. with my finger, would generally cause it to move into a more favorable position again. The eyes seemed less likely to roll upward when the child's head was held perfectly erect. In using no instrument for fixing the eyeball, I found it almost impossible to see the fundus well through the undilated pupil; a solution of atropine of one grain to the pint always caused sufficient enlargement. Nothing that caused pressure upon the globe was used in any case here recorded.

The children were obtained in the Maternity service of Charity Hospital, the N. Y. Foundling Asylum and the

Marion Street Lying-In Asylum. Probably they were all from the lower classes of society. It was never possible to examine more than one parent, and that the mother. I did not even succeed in examining enough mothers to be of any value. At one visit the mothers would be to ill to be examined; and at the next visit, perhaps, they would be gone from the hospital. It was rarely possible to examine a child a second time when desired. The prejudice of the mothers against having their infants utilized in this way was always an obstacle. These facts will be readily understood by all who are familiar with the population of our public institutions.

My examinations were discontinued sooner than I had intended, owing to their interference with other work and to the personal discomfort caused by the constant use of atropine in my own eyes. I hope to be able to add to them at some future time. Some of the mothers of the infants examined by me have been followed to their homes and I may be allowed to keep their children under observation, and to examine their eyes from time to time, as they grow up, Doubtless, a series of observations of that kind would be of value.

The only similar investigations with which I am acquainted are those reported by Professor von Jaeger of Vienna.* He published the results of examinations of 100 eyes in fifty children between nine and sixteen days old. He found 5 per cent. emmetropic, 78 per cent. myopic, and 17 per cent. hypermetropic. The following table[1], copied from his work, exhibits his results:

Strength of correcting glass in Vienna inches.	+15	+25	+40	0	−60	−45	−30	−20	−15	−12	−10	−8	−6
Newly-born children, 9–16 days old.		9	8	5		1		3	26	20	14	10	4

Von Jaeger concludes that the adjustment of the eye during the first days of life is predominantly a myopic one.[2]

* Ueber die Einstellungen des dioptrischen Apparates im menschlichen Auge. Wien., 1861.

1. *Id.* p. 20. 2. p. 10. 3. p. 11. 4. p. 26. 5. p. 31.

He says that this adjustment is due chiefly to a stronger curvature of the lens with a shorter distance of its anterior surface from the cornea.[3] He also expresses his belief in a congenital lengthening of the antero-posterior axis of the eyeball, causing a myopic adjustment,[4] and says that it is often easy to recognize in the eyes of the newly-born, the primitive forms of a conus.[5] He was led to the same conclusions, also, by measurements which he made of this same class of eyes in the cadaver. He affirms that the structure and adjustment of the eyes of the newly-born remain unaltered only for a short time—a few weeks—after which they change with the general development of the body.[6] "During the period of development, both hypermetropic and myopic eyes take on the normal structure; and eyes which were originally adjusted for parallel rays are, after this period, adapted, rarely indeed, for convergent rays, but often for divergent ones."[7]

"The eyes of the children in the first years of life show, also in individual cases, a difference in their dioptric adjustment. The majority are, however, adapted for greater distances, when in a state of full relaxation of the accommodation."

"As, in general, the adjustment for smaller distances is characteristic of the eye of the newly-born, so is the adjustment for greater distances characteristic of the eye of the child proper."[8]

No attempt is here made to explain the great difference between von Jaeger's statistics and mine, especially with regard to the percentage of myopia. Our methods of making the examinations were somewhat different, as I have

6. p. 15.

7. Sowohl übersichtige wie kurzsichtige Augen gestalten sich während der Entwickelungsperiode zum normalgebauten, und solche, die ursprünglich für parallele Strahlen eingestellt waren, sind nach dieser Periode wohl selten für convergirend-, dagegen häufig für divergirend-einfallende Strahlen adaptirt. p. 17.

8. Die Augen von den Kindern in den ersten Lebensjahren zeigen in den einzelnen Fällen ebenfalls eine Verschiedenheit ihrer dioptrischen Einstellung, überwiegend sind sie jedoch im Zustande voller Accommodationsentspannung für grössere Objectabstände adaptirt.

Gleich wie im Allgemeinen die Einstellung für geringere Entfernungen charakteristisch ist dem Auge Neugeborener eben so charakteristisch ist die Einstellung für grössere Entfernungen für das eigentliche Kindesauge. p. 15.

learned from a letter which he has very kindly written to me. He informs me that he did not use atropine in the eyes of the infants or in his own eyes: that he held the lids apart sometimes with his fingers, and sometimes (in case of great resistance on the part of the child), with lid-holders: that the children were laid on their backs upon a bed; that the examinations were made in the upright image, with weak illumination by a Helmholtz ophthalmoscope, consisting of three plane glasses.

In a recent article* by Dr. E. Landolt of Paris, he makes the following statement: "Infants are, in the great majority of cases, hypermetropes, even many of those who afterwards become emmetropes and myopes."† Dr. Landolt informs me, however, that he does not here refer to *newly-born* infants (as he has made no researches among them), but to infants beyond the first years of life; and that he has himself found such to be hypermetropic in the great majority of instances. Even infants of that age Von Jaeger found predominantly myopic. Among children between two and six years old, from an infant school, he found 62 per cent. myopic, and only 8 per cent. hypermetropic: among boys in the country, from six to eleven years old, 43 per cent. myopic, and 11 per cent. hypermetropic: among girls in the country, from five to eleven years old, 56 per cent. myopic, and 10 per cent. hypermetropic.‡

My statistics tend to establish the conclusion that emmetropia, myopia, and hypermetropia are all congenital conditions, with a preponderance of hypermetropia. Upon the causes of these differences of adjustment they throw no light. They afford no evidence of a congenital lengthening of the antero-posterior axis of the globe, or a congenital staphyloma posticum. Of course, they contain nothing so valuable as Von Jaeger's measurements on the cadaver.

* Sur les Causes de l'Amétropie. Communication faite a l'Association Française dans la séance du 27 Août, 1877.

† Les enfants sont, dans la grande majorité des cas, hypermétropes, même beaucoup de ceux qui deviennent plus tard emmétropes et myopes.

‡ As quoted by Donders.]

The use of so strong a solution of atropine in such young children may have increased the percentage of hypermetropia, through its supposed flattening effect upon the lens. In the twenty-seven cases measured under the weak solution, ten were myopic and fifteen hypermetropic—a less percentage of hypermetropia; but the number is too small for any definite conclusion. An attempt was made to examine the whole twenty-seven cases again a week later under the strong solution. Only six could be obtained, however; these were measured independently, and the former results confirmed in all save one.

If the myopia which was observed in these babies was due merely to the curvature and position of the crystalline lens, it might disappear the next week, or even give place to hypermetropia. At any rate, it would not be the kind of shortsightedness about which we feel anxious, and the finding of it thus early in life would be of no great practical value.

I am fully conscious of the difficulty of attaining perfect accuracy in such investigations as are here reported, and of the fallacy of conclusions drawn from such a small array of statistics. These are simply offered in the hope that they may prove a slight contribution to our knowledge of this subject.

My thanks are due to Sister M. Irene, Sister Superior of the N. Y. Foundling Asylum; to Dr. C. C. Lee, Dr. W. R. Gillette, Dr. O. D. Pomeroy, and Dr. W. E. Forest, of this city; to Dr. C. R. Estabrook, Chief of Staff, and Drs. A. B. Farnham, V. G. Culpepper, H. G. Lyttle, J. H. Bryan, J. Habirshaw and L. C. Swift, of the House-staff of Charity Hospital. Without their kind assistance my examinations could not have been made.

CLINICAL CONTRIBUTIONS.*

By D. B. St. JOHN ROOSA M. D., and EDWARD T. ELY, M. D.

(*With a wood-engraving.*)

I.

AMBLYOPIA FROM QUININE (?)

A CASE of amblyopia from supposed cinchona poisoning was published by Dr. Roosa in these archives, vol. viii., No. 3. Dr. Miranda, of this city, after reading the account of this case, informed us that he had met with a similar one, and was kind enough to induce the patient to present herself for examination. Through his courtesy, the following notes were obtained:

Mrs. B., aged 34, was seen on Nov. 7, 1879. She had a pernicious malarial fever in Cuba, in Nov., 1877. Upon one day she took 50 grains of the sulphate of quinine, 90 grains the next day, and 30 to 40 grains for the succeeding three or four days. At 11 P.M. of the day on which she took 90 grains of quinine she became blind, and remained so for the next three or four days. After that a gradual restoration of sight occurred. There were no aural symptoms. The intellect was clear most of the time. There was occasional delirium when the fever began, and when she was taking the large doses of quinine. The blindness was so complete that she had no perception of light. The testimony of her family physician and of her friends agrees with her own upon this point. No ophthalmoscopic examination was made.

She says that her vision was perfect before her illness, and that she has never seen as well since. Feels as if there was a veil over

* This paper was received Nov. 2, '79.—Editor.

her eyes. Cannot tell whether her linen is clean when it comes from the wash. Cannot do "shopping," because she no longer distinguishes colors well. Can see certain shades of dark-blue well, but distinguishes all other colors very imperfectly. Has most trouble with the different shades of red. When she first began to recover from blindness, had no color-perception whatever.

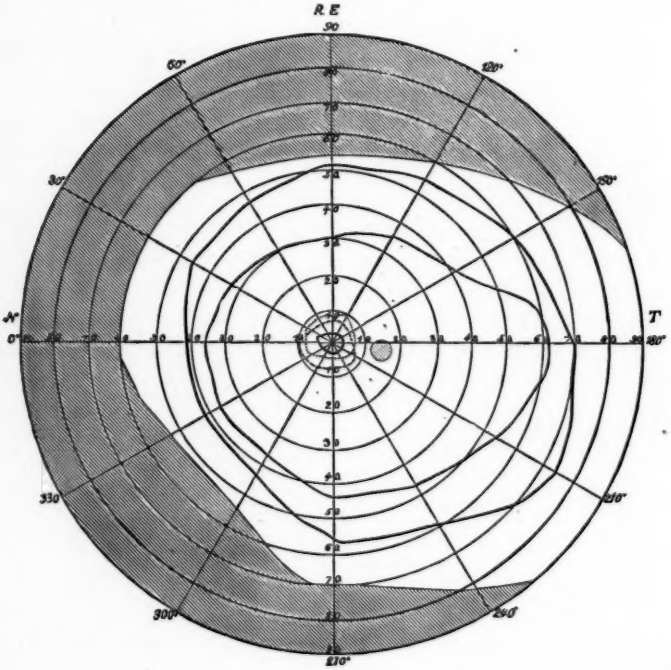
R. E., V.=$\frac{20}{40}$. Reads 1 Jaeger fluently.

L. E., V.=$\frac{20}{40}$. Reads 2 Jaeger with difficulty.

V. =$\frac{20}{30}$—with both eyes open.

With the ophthalmoscope, the fundus of each eye looks somewhat indistinct; the disks look too white; the capillaries seem deficient.

The visual fields (tested at 12″ by Carmalt's perimeter) are found concentrically limited, as is shown in the accompanying diagram, and are almost the same in both eyes.



The color-fields of the left eye are also shown. The right eye was not tested so fully, on account of the fatigue of the patient. There were no scotomata. In the diagram the second line from without inward represents the field for blue; then follow consecutively the fields for yellow, green and red.

There is, of course, no positive proof that quinine produced the amblyopia which has just been described. It may have come from malarial poisoning, from a neuritis in the course of the fever, or from some other cause.

The case is offered, like the one before reported, merely as a slight contribution to the subject.

Von Graefe reported some striking cases of amblyopia which he thought must have been caused by the use of quinine.*

Sir James Paget, in a recent number of the Contemporary Review, says. "large quantities of quinine will make a man, at least for a time, deaf and blind."

II.

TOTAL AMAUROSIS FROM CONCUSSION. RECOVERY.

P. M., aged 25, iron-railing maker, came on September 23d, with the following history: On September 21st, while drunk, he was kicked on the right side of the face. When he became sober a few hours later, he found that he had lost the sight of his right eye. There was no redness, swelling or pain in the eyeball or lids at any time. Is sure the vision of that eye was good before the accident, as he used the eye constantly in *sighting* railings. A leech had been applied to the upper lid by a friend as soon as the loss of sight was discovered, and the bite "bled for an hour."

An examination showed some superficial contusions about the cheek and temple. No swelling except from the leech-bite on the upper lid. All parts of the eye seemed perfectly normal. There was no perception of light. Tests for simulation gave negative results. The vision of the left eye was $\frac{20}{20}$, and not improved by any glass. The ophthalmoscope showed nothing.

Hypodermic injections of strychnia were ordered, chiefly for

* *Arch. für Ophth.*, Bd. 3, 2, p. 376

NOTE.—In a letter just received from Dr. L. M. Yale, he says that the patient whose case was reported in these ARCHIVES, vol. viii, No. 3, took a stronger tincture of cinchona than was at first supposed. Dr. Yale now estimates the amount of the alkaloid taken at 400–500 grains, instead of 125 grains as stated in the published report.

the purpose of keeping the patient under observation. An injection of $\frac{1}{60}$ gr. was given at once.

September 24th.—Injected $\frac{1}{40}$ gr. V. counts fingers at eighteen inches.

September 26th.—Injected $\frac{1}{30}$ gr. V. = $\frac{8}{40}$.

October 24th.—Has not been seen since September 26th. Says that he has been at work since that date, and that his sight has steadily improved; but he is sure that it is not as good as before the accident. Describes a slight *blur* over every object at which he looks. Has not the slightest pain or discomfort about eye.

R. E., V.=$\frac{20}{60}$. With $-\frac{1}{36}$c. 135°, V.=$\frac{20}{40}$. *L. E.* V.=$\frac{20}{40}$. Not improved by glasses. Reads 1 Jaeger at 6″ with either eye. Right visual field concentrically contracted. Measures 105° laterally and 80 vertically. No scotoma. With the ophthalmoscope the right disk appears much whiter than the left one (especially at the temporal side), and much whiter than on September 23d. The vessels of the retina seem somewhat reduced in size.

Patient has not been seen again. The recovery of sight in this case was not attributed to the strychnia.

A CASE OF PSEUDO-CYST OF THE RETINA ENCLOSING A FOREIGN BODY.

By GEORGE REULING, M.D., Baltimore, Md.

Mr. Geo. L. B., æt. 18, met, ten years ago, with the following accident:

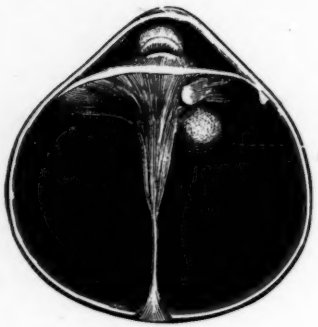
He placed a gun-cap on the piston of a toy-gun, and after repeated efforts at exploding it, succeeded finally with the unfortunate result of having his left eye seriously injured by a small piece of the explosive substance entering the ball. He was treated antiphlogistically at the time by the family physician, and, as no sight was left after the accident, the eye was considered lost. The young man went through a private school and afterward a collegiate course, almost unmolested from either eye, "except that the blind eye would occasionally show some redness and suffer with slight lancinating pains." During the time of graduation, when an extra amount of eyework was demanded of the young student, these attacks of pain and redness appeared quite frequently, and the right eye, which so far had held out most satisfactorily, began to be easily tired from reading; tears would flow after the least effort, and vision began to be slightly hazy for the distance.

At that time Mr. B. consulted me. The left (blind) eye showed the following condition: Vision totally lost, eyeball slightly shrunken, on palpation somewhat softer than normal and slightly painful; beginning phthisis anterior. Centre of cornea occupied by a triangular cicatrix, to which a small part of the atrophic iris was adherent, a dense pseudo-membrane occupying the entire pupil. An ophthalmoscopic examination was impossible.

Diagnosis.—Phthisis bulbi following irido-cyclitis with solutio retinæ, most likely caused by the presence of a foreign body within the eyeball.

The symptoms of the right eye being sufficiently manifest to be regarded as sympathetic irritation (incipient irido-cyclitis), immediate enucleation of the left eye was proposed and executed.

The enucleated ball, moderately reduced in size and tension, showed distinct impressions along the recti muscles. It was placed in Müller's liquid for ten days. A vertical section, made with a razor, exhibited the following highly interesting condition (see figure):



Sclerotic and choroid were intact, the retina was totally detached, and formed a complete funnel, the base of which was connected with the greatly hypertrophied ora serrata. This funnel contained about one-eighth of the degenerated vitreous body, in which, on microscopic examination, a great many cells and fibres of connective tissue were found. A completely round cyst (*a* in Fig.), the size of a large pea, was situated upon the external surface of the retinal funnel. Its walls were evidently formed by the continuation of the retina, while the base was partially constituted by the thickened hyaloid. In opening the completely closed bag by a transverse section, a light yellowish and thin liquid escaped, and within the cavity, loosely adhering to the inner surface of its wall, a piece of a gun-cap was found. It was triangular in shape, and weighed little over two grains.

Examination of cyst.—The wall of the cyst showed slight thickening at the point of fixation of the piece of metal; the latter was not capsulated by newly-formed tissue, but preserved its metallic lustre, and was hanging with a slightly hook-shaped corner on the inner surface of the cyst.

The microscopical examination of the cyst itself showed

a total destruction of the cones and rods, while the rest of the retinal layers showed hypertrophic degeneration of its elements with a considerable amount of connective tissue corpuscles and fibres interlacing the granular and cellular layers.

In the choroid there was a very small cicatrix situated near the horizontal meridian, 2, 5''' distant from the inner margin of the optic disk.

TETANUS TERMINATING FATALLY FROM ENUCLEATION OF AN EYEBALL.

REPORTED BY JULIAN J. CHISOLM, M.D.

SURGEON IN CHARGE OF PRESBYTERIAN EYE AND EAR CHARITY HOSPITAL, BALTIMORE, MD.

Mrs. W., æt. 71, in good health, had a tumor projecting from the front of the left eyeball which she desired removed. She gave the following history. One year since she suffered intensely with the eye, accompanied by loss of sight. Under treatment she was iridectomized for the relief of the glaucomatous pains. The operation gave temporary relief only. The wound did not heal kindly. In the course of time a small granulation appeared at the line of section. This has slowly developed into the present growth of bleeding cancer annoying her by its constant discharge, and frequent hemorrhages. The mass protruding from between the eyelids is the size of a large nut. It seems to have involved the entire face of the eyeball, and is about twice the size of the natural eye. When the lids are drawn widely apart they are found yet free, with no encroachment of the tumor growth over the upper or lower *cul-de-sac*. The tumor is very dark, especially at the inner canthus, indicating the presence of large vessels with thin walls. The tumor fills up the entire palpebral opening so that the finger cannot make pressure to test the lateral or posterior extent of the growth. As it moves freely, synchronous with the movements of the good eye, there is a strong presumption that the mass is chiefly a surface one, as far as the socket is concerned, and is incarcerated within the cone made by the recti muscles in their passage towards their attachment around the apex of the socket. From these evidences of isolation, the growth was deemed capable of easy and perfect removal, and the anxieties of the patient to get rid of a dangerous and troublesome disease were acquiesced in.

Under chloroform the extirpation was quickly and successfully accomplished. The mass when taken out was surrounded by healthy socket tissue in proof that the entire disease had been removed. Hemorrhage which was quite free was controlled by the usual plugging, and the patient was left very comfortable. One hour afterwards I was sent for and my attention called to blood oozing freely through the sponge compresses. The dressings were taken out, a compress saturated with a solution of the persulphate of iron was applied to the socket and well secured in position by sponge backing. From this time no further trouble from hemorrhage was experienced.

An incision into the tumor showed its origin to be choroidal. The vitreous cavity was filled with the growth which had broken through the corneal wound and had then extended on the anterior surface of the eye. The sclerotic surface of the eyeball was uniformly smooth, at no point had the disease perforated this coat, and the optic nerve where severed seemed quite normal.

Nothing peculiar exhibited itself during the convalescence. No blood was lost after the styptic dressing. In a very few days the purulent discharge from the socket induced by the persulphate of iron, was reduced to a minimum, and as the patient was out of her room and needed no further professional care I discontinued my daily visits.

On the fifteenth day after the operation I was sent for to see the patient. She was complaining of a sore throat with some discomfort in swallowing. She opened her mouth at the window, and I made a careful spoon examination but could find nothing. I called it a cold, using her expression, and treating it accordingly, suggested that she should call in her family physician if it continued to annoy her. The next day she referred to a stiffness of the jaw on the left side, corresponding to the eye removed. The mouth could still be widely opened for inspection. By the third day the mouth was opened with difficulty, and she had some trouble in swallowing. The jaws became more firmly contracted and swallowing was then accompanied by severe choking spells. Under combinations of bromide of pot. and hydrate of chloral, she got rest, and by nutrient enemata added to the small amount of liquids that she succeeded in swallowing, she seemed to retain strength. In this condition she remained for six days, at times swallowing milk with some readiness. Except the lockjaw and the choking paroxysms which attempts at swallowing gave her, she felt

well, suffered no pain, skin dry, abdomen soft, could lie in any position, and had no chest constriction. The neck was thoroughly relaxed and the head was carried in any desired position, the sterno-cleido-mastoid muscles showing no spasm. Opisthotonos did not supervene until the seventh day from the attack, and she died on the eighth day from the time she complained of the sore throat and the twenty-third day after the enucleation.

The case exhibits many curious points. The removal of an eyeball is one of the most common operations performed by the ophthalmic surgeon. In this country alone the removal of lost and painful eyes can annually be numbered by the thousands, and yet the loss of life following upon such an operation is of the rarest occurrence, so that we are accustomed to consider the extirpation of an eye among the least dangerous of surgical operations. A second point of interest is the age of the patient. At 71, the nervous system is not so readily impressed, and complications of a tetanic character are not looked for. A third point is that convalescence had well set in and the case was deemed nearly cured, when on the fifteenth day the first symptom of sore throat showed itself, a most unusual delay in the appearance of nervous complications. A fourth point was in the slowness of the development, three days before the jaw became locked, and seven days before opisthotonos involving the back muscles came on. It must ever be an open question what rôle the iron styptic played in the development of the tragedy. One would, however, have supposed that the cauterizing effect would have been sanitary, and that the irritation, greatest at the moment of application, would have long since passed off prior to the fifteenth day when the complication commenced to show itself. It is well to put upon record that no surgical operation is absolutely safe, and that from causes not appreciable a fatal tetanus may follow the removal of an eyeball.

COMPARATIVE DETERMINATIONS OF THE ACUTENESS OF VISION AND THE PERCEPTION OF COLORS BY DAY-LIGHT, GAS-LIGHT, AND ELECTRIC LIGHT.

By Prof. HERMAN COHN of Breslau.

Translated by H. Knapp.

1.—*Mode of Examination.*

As far as I know, no determinations of *S* and *CS* (sharpness of color-perception) by electric light have yet been made; even comparisons of these faculties by day-light and gas-light are wanting. Prof. O. Meyer had the kindness to allow me to use for my determinations the Gramme machine which is put up in his laboratory, moved by a steam-engine of three horse-power, and which furnishes a beautiful electric light. I have to thank Prof. Meyer and his assistants for their kind help in obtaining the most uniform light possible. Desiring to determine *S* and *CS* not only by electric light, but also by other illuminations, I used a room which had large windows, but could also be rapidly and totally darkened. The sky was variable, but mostly yielded sufficient light to show $S=1$ in a healthy eye. The test-types were illuminated by a bat's-wing gas burner, at a distance of one metre, screened from the eye of the observer. The electric light was furnished by the spark between two carbon-points, in a case open toward the test-types, likewise at a distance of one metre, while the Gramme machine made about 600 revolutions in the minute. In this manner, *S* was determined in 50 eyes, with Snellen's and Burchardt's test-types; furthermore *CS* in these 50 eyes with the apparatus of Adolf Weber (*Transactions of the Ophthalmological Congress at Heidelberg*, 1878, p. 130) which I will call chromoptometer. It was obtained from Ehr-

hardt & Metzger in Darmstadt, and consists of a number of colored round small pieces of paper pasted on black velvet and increasing in size at a fixed ratio. The colored paper disks have the following diameters: White, 6 *mm.;* blue, 10 *mm.;* yellow, 10 *mm.;* red, 6 *mm.;* green, 4 *mm.* According to Weber, their colors are recognized by the normal eye at a distance of ten metres. The apparatus of Weber contains a sufficient number of smaller and larger disks in each color, for differences between one and twenty metres. I have not used the violet and orange papers, since they are mixed colors.

It has not yet been sufficiently determined by experiment how large papers of different colors have to be in order to be recognized at equal distances. Donders thinks that the healthy eye recognizes *every* colored square of 1 *mm.* side at a distance of 5 *m.*, but a distance of 5 metres the following values were found by

Dor, by day-light—green, 2 *mm.;* yellow, 2.5; red, 3; blue, 8 *mm.* diameter.
" " candle-light " 2.5 " ; " 5.; " 2.5; " 16 " "
[At a distance of 20 *cm* from the candle.]
Weber, by day-light—green, 2 *mm.;* yellow, 5.; red, 3.; blue, 5 *mm.* diameter.

These observers, it will be seen, found marked differences for blue and yellow; but by day-light about the same values for red and green. I examined each eye apart, and, in case it was ametropic, with the corresponding glass. High degrees of M. and H. were not present among them; the coefficients of diminishing and magnifying power of the glasses, therefore, could be disregarded. In order to get reliable answers, I selected for these determinations physicists and physicians—persons whose faculties of observation were trained.

From the 50 eyes I obtained 864 determinations.*

2.—*S with Snellen's test-types.*

Very appropriate is Snellen's plate vi, containing six lines of Latin letters, all to be read at a distance of six metres.

* The German edition contains all these and the succeeding determinations in a number of tables, which in the English edition have been suppressed, since the results of each series of investigations are given fully and more comprehensively in the context.

Different ages showed that young emmetropes examined by day-light had mostly $S=1$ or >1, older myopes had mostly $S<1$, even $S=0.5$, without any disease.

In the following, *Sd* denotes visual acuteness by day-light; *Sg*, visual acuteness by gas-light; and *Se*, visual acuteness by electric light. I examined 44 eyes as to *Sd* and *Sg* with Snellen's test-types. In 20, $Sd=Sg$; in 24, $Sd>Sg$; the diminution of *S* in the latter varying between $\frac{1}{10}$ and $\frac{5}{10}$; in one case only it was $\frac{9}{10}$; *Sd* in this case, however, being equal to 1.5.

Fifty eyes were compared with regard to *Sd* and *Se*. Results: in 16, $Sd=Se$; in 29, $Sd<Se$; in 5, $Sd>Se$. The increase of *S* by electric light varied between $\frac{1}{10}$ and $\frac{5}{10}$, in 2 cases it was $\frac{7}{10}$. In the 5 cases with $Se<Sd$, atrophy of the optic nerve was present. It has long been known that patients affected with this disease see worse in bright light.

In detachment of the retina, in glaucoma, *Se* was greater than *Sd*.

Forty-four eyes were examined as to *Sg* and *Se*; in 90 per cent. *Se* was considerably larger (from $\frac{2}{10}$ to $\frac{5}{10}$, even $\frac{9}{10}$) than *Sg*. An exception was only found in cases of atrophy which saw a little worse by electric light.

The final result showed that in the great majority of cases $Se>Sg$ and $>Sd$, and that $Sg<Sd$. But in the brightest electric light *S* was no greater than 1.5.

S being 1, the breadth of the letters gave the visual angle $=0°\ 1'$; but *S* being 1.5, the visual angle becomes $0°\ 0'\ 45''$. A visual angle of $1'$ corresponds to a retinal image of nearly 0.004 *mm*. (See Mauthner, Lectures on the Optical Anomalies of the Eye, p. 127.) In the brightest electric light, with S=1.5, the diameters of the smallest distinguishable retinal image would be 0.003 *mm*.

3.—*S according to Burchardt.*

Only forty-four eyes were examined with Burchardt's point-tests; sixteen of them showed a diminution of *S* by gas, even ten counted the points farther by gaslight than by daylight—a result considerably at variance with that obtained by Snellen's letter-tests. The diminution of *S* by

gas varied between $\frac{1}{10}$ and $\frac{5}{10}$, the increase of *S* was almost exclusively found in eyes that showed a diminution of *S* by daylight. In most cases, it was no more than $\frac{1}{10}$, in one eye, however, it was $\frac{3}{10}$, and in another, $\frac{5}{10}$.

Fifty eyes were examined by *electric light*. Burchardt's points were in almost all cases counted farther than by daylight. The increase of *S* was sometimes quite enormous, mostly $\frac{3}{10}$ to $\frac{5}{10}$, frequently $\frac{7}{10}$ to $\frac{8}{10}$, in three cases even $\frac{10}{10}$, and in one $\frac{28}{10}$. In three cases, *S* was diminished by $\frac{1}{10}$ to $\frac{2}{10}$. A comparison between *Sg* and *Se* from Burchardt's tests shows that in almost all cases *S* by electric light exceeds very considerably *S* by gas light. Never was $Se < Sg$.

4.—*The brightness of different colors by daylight, gaslight and electric light.*

(Original communication by Prof. O. Meyer, of Breslau.)

Before comparing the visual acuteness for the different colors of Weber's chromoptometer I subjoin, with the kind permission of Prof. Meyer, his interesting investigations on the intensities of the different kinds of light here made use of.

"To find the brightness of different colors by gaslight and electric carbon light, their spectra were compared with that of the sun by means of Vierordt's spectroscope. One of the two slits through which light enters the apparatus was illuminated by daylight, the other by an Argand gas-burner 0.75 metre distant. The breadth of the first slit was kept unchanged, whereas the width of the other was regulated in such a manner as to let that part of the spectrum which alone remained visible through the diaphragm in the eye-piece of the telescope appear equally bright in both spectra. The required width of the slit is a direct measure of the brilliancy in which the observed part of the gas spectrum appeared in comparison with the corresponding part of the daylight. The micrometer screws produced the following results at the graduated measure indicating the width of the slit.

COLOR.	FRAUNHOFER'S LINE.	DAYLIGHT.	GASLIGHT.
Red	*a*	55	15
Red	C	55	17
Yellow	D	55	20
Green	E	55	40
Blue	F	55	40
Violet	G	55	64

"The numbers indicate directly how rapidly the brilliancy of light in the gas spectrum diminishes from the red to the violet end. In the same way electric, at a distance of about 0.75 metre, was compared with sunlight received by the spectroscope from a heliostat after a triple reflection. The comparison could not be made with the same completeness and accuracy, since the slit had to be taken much narrower. It was found:

COLOR.	SOLAR LIGHT.	ELECTRIC LIGHT.
Red	11	22
Yellow	11	13
Green	11	22
Blue	11	18
Violet	11	40

"According to this, electric light when compared with sunlight suffers from a *want of violet rays*, though not in the same degree as gaslight. The same result was obtained from an experiment to compare the brilliancy of the electric light with that of the solar light by means of Ritchie's photometer. When the photometer was 0.25 *m.* distant from the electric lamp, both surfaces appeared equally bright, but that illuminated by sunlight appeared purely white, that illuminated by electric light had a yellowish orange tint.

"The significance of the above numbers is best recognized after a slight permutation. If it were possible to obtain artificial lights which in yellow were equal to the brilliancy of sunlight, the brilliancy of the other colors would be to that of the solar light, as follows:

COLOR.	GAS.	ELECTRIC LIGHT.
Red	1.2	0.6
Yellow	1.0	1.0
Green	0.5	0.6
Blue	0.5	0.6
Violet	0.3	0.3

"The above statement shows that electric light compared with sunlight appears somewhat yellow, gaslight compared with sunlight appears orange, gaslight compared with electric light appears red-yellow or brownish, electric light compared with gaslight appears as a bluish-violet white."

These observations of Prof. Meyer are so much the more important as such photometric comparisons of the electric light have, to my knowledge, not yet been made.

5.—*S for Red.*

Forty-four eyes were examined with Weber's chromoptometer; one-third of them recognized red by daylight farther than Weber indicates, namely, 14 eyes had *Srd* (visual acuteness for red by daylight) >1, in the afternoon hours of the rainy month of March.

Gaslight diminished *Sr* (visual acuteness for red) only in one-third of all eyes, namely, by $\frac{2}{10}$ to $\frac{6}{10}$. In almost half of the cases, *Sr* was even increased by gaslight, namely, in all cases in which *Srd* <1. The increase of *Sr* by gaslight was mostly from $\frac{2}{10}$ to $\frac{4}{10}$, but went as high as $\frac{15}{10}$. This increase of *Srg* is perhaps due to the great quantity of red rays which Prof. Meyer has found in gaslight. Totally different was the relation of *Sre* to *Srd*. Among 50 eyes, 49 obtained an increase of *Sr* by electric light. This increase was quite enormous in healthy eyes, namely, from $\frac{10}{10}$ to $\frac{45}{10}$, an increase of from $\frac{15}{10}$ to $\frac{20}{10}$ being very frequent. A diminution of *Srd* by electric light never occurred. But also all diseased eyes showed *Sre*$>$*Srd*.

Comparisons of the visual acuteness for red by gaslight and electric light showed that in all cases *Sre*$>$*Seg*. Of 24 eyes with *Srg*$=$ or >1, one eye obtained by electric light six times, one eye four times, seven eyes three times, and

thirteen eyes double the visual acuteness for red which they possessed by gaslight. In all other cases, the perception of red was also considerably increased by electric light.

6. *S for green.*

Almost all eyes had difficulties in distinguishing green from blue by gaslight; some even by daylight at a greater distance. Of 44 eyes examined, 4 had *Sgr* (*S* for green) <1; 3, $Sgr=1$; all others less than one. The sizes for green chosen by Weber are perhaps too small for the majority of eyes. The above condition contrasts conspicuously with the results of my examinations for red. In half of the cases the perception of green was considerably smaller by gaslight than by daylight, from $\frac{1}{10}$ to $\frac{6}{10}$. In 13 cases among 44 it was increased by gaslight, but only in such where $S<1$. In all cases of atrophy of the optic nerve, *Sgr* was increased by gas. The results obtained from examination with the electric light were totally different. Of 50 eyes, among which one with atrophy of the optic nerve, only three showed $Sgrd=Sgre$. The remaining 47 obtained improvements by electric light, varying from $\frac{5}{10}$ to $\frac{15}{10}$. Also, the majority of cases of atrophy of the optic nerve and detachment of the retina showed $Sgre>Sgrd$. Comparing, in conclusion, gas with electric light, we find only in two eyes out of 44 $Sgrg=Sgre$; in the remaining 42, $Sgre>Sgrg$, and mostly very considerably greater. From this it follows that the perception of green (the green-sense) is very materially increased by electric light.

7. *Visual acuteness for blue* (*Sb*).

The recognition of blue is especially difficult at great distances, by its slight contrast with the underlying black. While green was mostly taken for blue, the majority of observers perceived blue at a distance, not as green, but as dark. Of the 44 eyes, 6 only had $Sbd>1$; $4=1$; all others <1. Gaslight diminished *Sb* in all cases in which $Sbd>$ or

$=1$ or $=0.8$, by from $\frac{3}{10}$ to $\frac{10}{10}$. Cases with $Sbd<1$ were in part improved, in part made worse by gaslight.

Electric light raised S for blue in 88 per cent. of the cases. Of 50 eyes, only five had $Sbd=Sbe$; in one case alone I found $Sbe=0.8$, against $Sbd=1.5$, which is possibly an error of observation, since the other eye of the same patient showed in all other determinations equal results, yet had $Sbe=3$, against $Sbd=1.5$.

The perception of blue, therefore, is almost always improved by electric light, namely, by from $\frac{3}{10}$ to $\frac{15}{10}$.

Comparisons between visual sharpness for blue by electric light with that by gaslight, showed in almost all cases (94 per cent.) $Sbe>Sbg$, mostly very considerably so—from $\frac{4}{10}$ to $\frac{14}{10}$.

8. *Visual acuteness for yellow* (*Sy*).

Many observers found it difficult to distinguish yellow from white, even by daylight. Nineteen eyes among 44 have $Sy=1$ by daylight. The diameter of the yellow disks of Weber was perhaps too large, for $Sy=3$ was not rare. Gaslight showed different results: in two cases it did not change Sy, in 23 cases it diminished it. This was in almost all eyes with $Syd>1$. On the other hand, it increased Sy in all cases with $Syd<1$.

Electric light never produced diminution of Sy. Of 50 eyes, only nine showed $Sye=Syd$. In the remaining 41, Sye was $>Syd$. It follows that the perception of yellow is very materially increased by electric light, frequently amounting to from $\frac{15}{10}$ to $\frac{30}{10}$. Even diseased eyes were considerably improved. A red-green blind person had threefold S compared with daylight.

Comparisons of electric with gaslight showed an improvement in all eyes except one, in which Sye was $=Syd$. The improvement in most cases was very conspicuous.

9. *Concluding remarks.*

Recapitulating the principal results of the foregoing investigations, we arrive at the following conclusions:

A. Concerning Normal Eyes.

1. Gaslight compared with daylight does not change S in a portion of the cases on examination with either Snellen's or Burchardt's tests: in another portion it diminishes S by from $\frac{1}{10}$ to $\frac{5}{10}$; very rarely it increases S by $\frac{1}{10}$ (the latter with Burchardt's tests only).

2. Electric light compared with daylight increases S in almost all cases, on the average by from $\frac{1}{10}$ to $\frac{5}{10}$; electric light compared with gaslight raises S on an average from $\frac{2}{10}$ to $\frac{5}{10}$.

3. The sharpness of vision rises also in Burchardt's tests, with the increase of the intensity of illumination, but it reaches, in spite of electric illumination, a limit in harmony with Snellen's tests. S by electric light, tested with Snellen's type, does not exceed 1.5, and tested with Burchardt's points does not exceed three, that is the smallest visual angle with Snellen's tests is $45''$; with Burchardt's tests, $42''$, corresponding to a retinal image of 0.003 *mm*.

4. The photometric experiments of Prof. O. Meyer showed that electric light, compared with sunlight, appears somewhat yellow; compared with gaslight, bluish-violet white; gaslight compared with sunlight appears orange; compared with electric light, appears red-yellow or brownish.

5. The size of colored disks in Weber's chromoptometer does not yet seem correctly chosen for the average eye. Red and yellow by daylight is distinguished farther, blue and green less far than Weber states. It is particularly difficult to distinguish green from blue and yellow from white. To determine the smallest colored disks, examinations on a very large scale are required.

6. Gaslight increases the sharpness of vision for red, yellow, green and blue, in most cases that have S for these colors by daylight <1; it diminishes it when S by day >1.

7. Electric light almost always increases the perception of colors by daylight, at an average the perception of red by from $\frac{10}{10}$ to $\frac{40}{10}$, the perception of green by from $\frac{15}{10}$ to $\frac{25}{10}$,

the perception of blue by from $\frac{5}{10}$ to $\frac{15}{10}$, the perception of yellow by from $\frac{15}{10}$ to $\frac{30}{10}$.

8. Electric light always improves the color perception when compared with gaslight, on an average the perception of red from two to six times, the perception of green from two to seven times, the perception of blue from one and a-half to two times, the perception of yellow from two to five times.

B. Concerning Diseased Eyes.

9. In atrophy of the optic nerve the visual acuteness by electric light either remains the same or is diminished, but it is improved for all colors.

10. In detachment of the retina and disseminate choroiditis, *S* and *CS* (sharpness of color perception) are always improved by electric light. In red-green blindness not only an improvement of the perception of yellow and blue is produced by electric light, but also an improvement of *S* in recognizing red and green as one color (probably yellow.)

In the following article I shall publish further determinations of the sharpness of color perception in direct sunlight and electric light. It will be seen that the normal eye, under favorable conditions, is capable of discriminating colors at distances far exceeding those hitherto assumed.

QUANTITATIVE DETERMINATION OF COLOR-SENSE.

By Prof. Dr. HERMAN COHN, of Breslau.

Translated by J. A. Spalding, M.D., Portland, Maine.

A. Observations by electric light.

At the close of my article, "Comparative determinations of the acuteness of vision and the perception of colors by daylight, gaslight and electric light" (see the preceding paper), I remarked that I was at present engaged in further researches on the acuteness of the color-sense by *direct sunlight* and *electric light*, which result in showing that the distances at which the normal eye under favorable circumstances differentiates colors as such, are *exceedingly greater* than has hitherto been believed.

The following tables will confirm this conclusion. I had discovered in my previous experiments with electric light that in a few cases the length of the rooms at my disposal (6 meter) was not sufficient to discover the extreme limit of perception of red by Weber's chromoptometer. But it seemed to me so much the more needful to determine the limits of colors, as the results of different authors still vary so much on this point. Donders is of the opinion that *all* colors of 1 *mm.* diameter can be distinguished by good daylight even at 5 *m.*; Dor and Weber, independently of one another, picked out a green paper of 2 *mm.* and a red of 3 *mm.* at 5 *m.* distance; Dor fixed 2.5 *mm.* for yellow, Weber 5 *mm.*; Dor for blue 8 *mm.*, Weber 5*mm.*

In my former experiments it was indifferent, whether the numbers attached by Weber to his apparatus were absolutely correct or not; the acuteness of color sense was de-

termined with these by *various degrees of illumination*, and the question was only of *relative* comparison. In the following determinations, however, I wished to find *absolute* quantities.

My astonishment was very great when I discovered that even the longest room in the physiological laboratory in which I carried on my experiments by the kindness of Prof. O. Meyer was not long enough to determine the limits of perception of colored disks of 1 *mm.* in diameter.

I was obliged to open door after door (running on the same axis) of various rooms, to make a path 30 *m.* long, in order to gain a distance at which the small bits of colored paper could no longer be seen.

As all these rooms could not be satisfactorily darkened in the day time, my experiments were all performed in the evening between 9 and 11, but were hindered somewhat in that, owing to the great distances the conversation had to be carried on in a loud voice. I had caused pieces of Heidelberg flower paper 1 *mm.* in diameter, in white, red, yellow, green, blue, orange and violet (the very same shades used by Weber in his chromoptometer) to be fixed to an octagonal drum covered with the best black velvet, in such a manner that each piece stood alone upon a large black velvet surface of 15 □ *cm;* by revolving the drum the colors could be quickly alternated. A second similar drum was furnished with colored papers of 2 *mm.* diameter. An electric carbon light produced by Gramme's machine stood 1 *m.* in front of the drum, and behind the drum was hung a large square of black paper, which, however, by electric light appeared of an elephant-gray tinge.

Each observer used Weber's tube to ward off any side light from the eye; each eye was tested separately, and those slightly ametropic with neutralizing glasses.

It will first be seen from Table I, that I chose only eyes with good *S*, and that, as in any previous tests, the observers were all naturalists who gave unprejudiced and precise accounts.

The table further demonstrates that *by no means does the perception of color, as was previously assumed, ensue directly*

after the dot has appeared as bright. Red, e. g. appeared as bright at 17 *m.*, and as red at 15 or 14 *m.*; green at 30–24 *m.* as bright, but green only at 14–13 *m.*; blue as bright at 10, as blue at 3 or 2 *m.*; yellow 22 bright, 15 yellow; orange 20 bright, 14 reddish, 7 orange; violet 15 bright, and 3 violet.

The table shows further, *that in healthy people there are great individual variations in the distance at which the colored spots still appear bright.* (Of course, all dazzling and fatigue were avoided during the experiments.) The perception of red as a bright point fluctuated between 13–17 *m.*; green between 15–30 *m.*; blue 8–10 *m.*; yellow 15–22 *m.*; orange 20–27 *m.*; violet 11–16 *m.* All the observers saw white as a bright point at 28 *m.*, and if the space had been larger it might have been seen even further.

Also the individual limits of color perception vary considerably in healthy eyes. The distances at which 1 *mm.* red appeared distinctly as red amounted to 11.5, 13, 13, 14, 15 *m.*; green 8, 9, 13 (2) 14; blue 0.5, 1, 2, 3, 8; yellow 1, 3, 4, 5, 6; orange 3, (3), 7, 8; violet 1, 1.5, 2, 3, 4.

There were many cases of *confounding the colors*, before the dots were seen of the *correct* color. Red only was always seen as red; green was for some time mistaken for blue or white; blue for white or violet; *yellow could only be distinguished from white with the greatest difficulty.* Dr. Struwe, e. g., saw a yellow point at 22 *m.* as bright, at 15 as yellow, at 14 again as white, at 10 white, at 3 white or yellow, and only at 1 *m.* as distinctly yellow. This continual confusion, of course, occurred also when a white point was exhibited. Compare Table I, for white.

The mixed colors, orange and violet, offered especial difficulties. As seen from Table I, there was a continuous alternation between the components, until the observer was very close to the test. On the average, however, orange was recognized even farther than violet, since the contrast of orange against black is greater than that of violet against black. The first two horizontal columns of Table I, show that *both eyes* of the same person gave by no means the same limits of color-perception.

TABLE I.

Limits of Color Perception by Electric Light.

No.	Name.	Eye.	Age.	S. and Refraction.	Size of Color.	Red.	Green.	Blue.	Yellow.	White.	Orange.	Violet.
1	Prof. O. E. Meyer.	R.	44	S. 1 Em.	1 *mm.*	17 *m* reddish, 15 plainly red	11 bluish, 8 green.	10 bright, 0,5 violet.	21 bright, 13 green, 7 white, 6 yellow.	28 bright, 22 bright, 16 white.	24 bright, 22 reddish, 17 not reddish, 12 still reddish, 9 reddish, 6 yellowish, 3 distinctly orange.	16 bright, 10 gray, 8 perhaps bluish, 6 somewhat reddish, 4 violet.
2	Prof. O. E. Meyer.	L.	44	S. 1 H. 0,25	1 *mm.*	17 bright, 14 red.	15 bright, 13 changeably red, 11 not red, 9 green.	8 bright, 4 blue ? 3 blue.	1) 8 white, 2,5 yellow, 2) 20 bright, 9 yellow or white, 4 yellow.	28 bright, 20 bluish, 13 white.	20 bright, 14 seems reddish, 7 orange.	5 reddish. 2,5 orange, 1 violet.
3	Mr. Wolf, Medical Student.	R.	21	S. 1,5 Em.	1 *mm.*	1) 13 red, 2) 13 red, 3) 12 red.	24 bright, 13 green. 10 green or white, 7 white.	10 color, 4 white, 1 white-blue?	15 bright, 12 white or yellow, 9,5 white, 6 yellow ? 5 yellow.	28 bright, 18 distinctly yellow, 6 yellow or white, 3 white.	13 red, 9 orange? 8 orange.	11 a point, 3 white, 2 orange, 1,5 violet.

4	Dr. Struwe, Oculist.	L.	32	S. 1 M. 1	1 *mm.*	16 bright, 13 red.	20 bright, 14 green.	10 bright, 8 blue.	22 bright, 15 yellow, 10 white, 3 white or yellow, 1 yellow.	28 bright, 20 white and remains so.	21 bright, 14 perhaps greenish, 10 perhaps violet, 7 decided violet, 3 orange, 2 yellow ?	13 a point, 8 somewhat blue, 6 very steel-blue, 4 perhaps violet, 3 violet.
5	Langer, Medical Student.	R.	24	S. 1 M. 0,5	1 *mm.*	13 bright, 11,5 red.	30 bright, 13 green.	10 bright, 5 green, 2 violet or blue.	18 bright, 12 quite green, 6 bright, 3 yellow.	28 bright, 18 white.	20 bright, 15 reddish, 8 yellow or orange, 3 orange.	15 a point, 7 yellow, 3 white, 2 more blue.
6	Wolf, Medical Student.	R.	21	S. 1,5 Em.	2 *mm.*	28 colored, 24 distinctly red.	28 bright, 26 green.	11 a point, 9 violet, 8 blue.	28 bright, 20 white, 2 yellow.	28 white and remains so.	28 bright, 20 perhaps orange, 8 decidedly orange.	15 a point, 8 red, 6 orange, 1 violet.
7	Dr. Struwe.	L.	32	S. 1 M. 1	2 *mm.*	26 bright, 22 red.	28 a point, 20 green ? 18 decidedly green.	16 a point, 11 blue.	28 bright, 20 yellow, 6 white, 1 white or yellow,	25 white.	25 bright, 17 violet, 8 orange.	24 a point, 10 violet, and remains so.
8	Langer, Medical Student.	R.	24	S. 1 M. 0,5	2 *mm.*	1) 28 bright, 26 red ? 20 red. 2) 28 bright, 22 red, 20 surely red.	28 bright, 18 green.	21 bright, 14 red, 10 green, 7 blue or green, 5 blue.	28 bright, 22 yellow, 15 white or yellow, and continually changing to 1 *m.*	28 bright, 18 greenish, 17 white.	28 bright, 24 changing alternately to red, 18 per. orange 11 red, 8 distinctly orange.	20 bright, 5 red or violet, 3 violet.

I tried in three cases to answer the question, *whether pigmented papers of 2 mm. could be seen twice as far as those of 1 mm.*

The figures for red harmonize pretty well:

Dr. Struwe saw 1 *mm* up to 13 *m.*; 2 *mm* up to 22 *m* as red.
Mr. Wolff " 1 " " 12 "; 2 " to 24 " "
Mr. Sanger " 1 " " 11.5 "; 2 " to 20 " "

For green, the distances were found to be as 13:26, 14:18, 13:18. For blue, 1:8, 8:11, 2:5; and for yellow, 5:2, 1:1, 3:1. These quite abnormal conditions can be explained by the continual confusions which arise between blue and green on the one hand, and between yellow and white on the other. The results for orange and violet are still less to be compared for the same reasons. For white of 2 *mm.*, we should have had at our disposition a path even longer than 30 *m.* But on the whole we may conclude: *Healthy eyes, by electric light, see colored points of 1 mm. as follows: red at 11–15 m., green 8–14, blue 0.5–8, yellow 1–6, orange 3–8, violet 1–4, white 16–20, i.e., considerably farther than by good daylight.*

B.—*Observations by direct sunlight.*

It was naturally of great interest to repeat these experiments by *direct sunlight*, since so far as I know, no observations have as yet been made on this point.

The small apparatus before described was then placed under the open sky in direct *sunlight*, and ten normal eyes—three of which had before been tested by electric light—examined in this way. The tests were made during very sunny hours from June 1st to 8th, 1879, between 9 and 11 o'clock; the first three in a court-yard 40 *m.* long, and the others in my garden, 22 *m.* long.

The examination was stopped the moment that even the slightest cloud concealed the sun. All observers (whose statements were precise and careful) used Weber's tube; all had $S=1$ or >1. Those who were slightly myopic, were furnished with neutralizing glasses.

The results are collected in Table II, on page 68.

As we see from Table II, the appearances in direct sunlight are very similar to those by electric light. *Here also there is a greater distance within which the color is first perceived as only a bright spot.*

Red appeared as Bright at 22 or 30 *m.*, and as distinctly Red at 14–16 *m.;* Green at 22–32 *m.* as Bright, and at 9–10 *m.* as distinctly Green; Blue 14–22 *m.* as a point, but mostly 5–8 as Blue; Yellow shone furthest as a bright spot, in one case (Z) so far as 40 *m.* In all the other cases at 22 *m.* as decidedly Bright, but as Yellow only at 7–12 *m;* Orange and Violet as Bright at 22 *m.* as distinct colors only at 4–6 *m.*

A *White* point of 1 *mm.* was always seen at 22 *m.*, and where we had at command a space of 40 *m.* it was indeed seen at 33–37 *m.* We have here also the same considerable doubt whether the color is *Yellow or White* as by electric light. But when the point was of 2 *mm.* it was distinctly recognized as White at 22 *m.*

By direct sunlight also, the limits of *color-perception* vary considerably in various healthy individuals. The distance at which the color was distinctly seen as such, was:

For Red, 10, 11, 13, 14, (3), 15, 16, (2), 19, Meter.
For Green, 5, (2), 6, 8, 9, (3), 10, 18, (2), "
For Blue, 2, 3, (2), 4, 5, 8, (3), 9, (2), "
For Yellow, 3, (2), 4, 7, 9, (2), 10, 12, 17, 22, "
Orange, 1, (2), 2, (2), 5, 6, 8, 11, 16, (2), "
For Violet, 1, (3), 2, (4), 3, 4, 7, "

A glance at Table II, shows that there were the same mistakes in direct sunlight as in electric light, before the colors were distinctly recognized. Thus: Red was at first taken for Yellow-Red; Green for a long time for Blue; Blue for White or Green, and Yellow for White. But there was here no case whatever of successive contrasts. Here again Orange and Violet caused the greatest difficulties, in which the observers, until they were very close to the test, often remained undecided between the component colors.

In two cases (Sanger and Miss Sch.) the tests were made with one eye, and then with both. *But no noticeable im-*

Table II. **Limits of Color**

Name .	Merchant T.	Manufactr. Z.	Merchant Fr.	Student Langer.		
Age .	54	41	21	24		
Eye .	L.	R.	R.	R.	L.	Both together
Ref. & S.	Em. S. $\frac{6}{6}$	Em. $\frac{6}{4}$	Em. $\frac{6}{6}$	M. 0,5. S. 1.	M. 1.5. S. 1.	with glasses S. 1
Size of Object.	1 *mm.*	1 *mm.*	1 *mm.*	1 *mm.*	1 *mm.*	1 *mm.*
White.	33 *m.* a point, 27 bright, 16 yellowish, 13 silvery, 10 gold yell'w 9 green yell'w 7 gold yellow, 1 white.	37 *m.* a point, 21 white.	34 *m.* a point, 30 reddish, 17 reddish, 12 white.	22 *m.* bright, 20 yellow, 9 white.	22 *m.* bright or yellow, 18 yellow or white, 13 white ? 10 distinctly white.	22 *m.* white, 14 yellow, 10 distinctly white.
Red.	18 a point, 14 yellowish, 13 reddish, 11 yellow, 10 red.	20 a point, 17 reddish, 16 red, 10 orange, 6 orange, 4 red.	30 a point, 25 " 17 reddish, 16 red, 13 dark red.	20 bright, 14 yellowish- red, 11 red.	22 bright, 20 red reflex, 18 red ? 14 distinctly red.	22 bright, 20 yellow or orange, 10 distinctly red.
Green.	22 a point, 12 bluish, 6 blue green, 4 greenish, 3 green.	32 a point, 30 whitish, 16 bright yel- low blue, 13 milky blue, 8 green, 7 distinctly bright green.	34 a point ? 30 dis. a point 18 blu.-green, 15 bluish, 14 blue, 10 " 5 brighter blue-green.	22 bright, 13 blue ? 9 green.	22 bright, 10 green.	22 bright, 12 green ? 9 blue, 7 green.
Blue.	14 a point, 8 bluish, 6 " 2 blue.	19 a point, 10 bluish, 8 blue.	19 a point, 14 grayish, 12 bluish, 9 blue.	22 a point, 14 green ? 9 blue.	22 a point, 9 blue ? 8 blue.	22 a point, 6 blue.
Yellow.	25 a point, 18 colored ? 12 greenish ? 9 yellow, 6 golden yel- low.	40 a point, 30 gray, 25 white, 3 yellow.	35 a point, 29 gray, 25 whitish, 12 almost orange, 6 bright, 4 yellow.	22 bright, 19 yellow, 10 white, 9 yellow, 7 yellow.	22 bright, 20 yellow, 15 yellow or white, 10 yellow and remains so.	22 bright, 20 yellow, 14 white, 8 yellow, 6 green ? 2 yellow.
Orange.	21 a point, 19 reddish, 14 red, 11 fiery red, 6 yellow red, 4 yellow ? 1 orange.	36 a point, 24 pale rose, 20 orange ? 16 orange and remains so.	33 a point, 29 dark point, 20 reddish, 18 flame red, 6 red, 1 orange.	22 bright, 19 red, 10 yellow red, 7 red dis- tinctly, 5 orange.	22 bright red- dish, 16 orange ? 10 orange, 6 distinctly orange.	22 bright red- dish, 15 orange, 12 red, 9 distinctly orange.
Violet.	19 a point, 11 reddish, 9 bright red, 6 yellow ? 4 yellow, 2 distinctly yellow, 1 lilac.	21 a point, 6 whitish, 4 " 2 violet.	19 a point, 16 dark, 10 gray.-red, 6 reddish, 4 whitish, 2 blueish, 1 blue or vio- let	22 bright, 9 reddish, 7 bright, 4 yellow red, 3 orange ? 2 violet.	22 bright, 9 yellow ? 5 orange ? 3 violet.	22 bright, 10 red, 3 violet ? 2 violet.

Perception by Direct Sunlight.

Student Wolf.		Dr. Struwe.		Miss Sch.		
20		32		22		
R.	L.	L.	L.	R.	L.	Both.
Em. S. $\frac{4}{4}$	Em. S. $\frac{4}{4}$	M. 1. S. 1.	M. 1. S. 1.	Em. S. $\frac{4}{4}$	Em. S. $\frac{4}{4}$	Em. S. $\frac{4}{4}$
1 *mm.*	1 *mm.*	1 *mm.*	2 *mm.*	1 *mm.*	1 *mm.*	1 *mm.*
22 *m.* yellow, 10 yellow or white, 5 white.	22 *m.* white, 14 white or yellow, 6 yellow or white, 4 white distinctly.	22 *m.* a point, 20 white and remains so.	22 *m.* white and remains so.	22 *m.* white, 15 bluish, 3 bluish or green? 1 yellow or white.	22 *m.* white, 10 yellow, 2 white?	22 *m.* white, 14 yellow, 4 white, 2 bluish, 1 white.
22 orange? 13 red.	22 a point, 17 red, 14 distinctly red.	22 point, 19 red.	22 red.	1) 16 red. 2) 16 point, 15 red.	1) 16 violet, 14 red, 2) 18 a point 14 red.	1) with tube: 22 a point, 18 red. 2) with't tube: 20 red.
22 a point, 10 blue? 5 green.	22 a point, 11 green or blue, 9 green.	22 a point, 9 green.	22 blue or green, 2 distinctly green.	20 a point, 18 green and remains so.	1) 22 point, 18 green, 14 white, 4 green, 2) 22 point, 15 green, 5 white, 1 green.	1) with tube: 22 green, 2) with't tube: 16 yellow, 11 blue, 10 green.
22 a point, 5 blue or green, 2 blue.	1) 22 a point, 8 white? 4 blue? 2) 12 white or yellow, 3 blue?	1) 14 a point, 11 blue, 2) 15 a point, 8 violet or blue.	22 a point, 17 blue.	10 a point, 5 blue.	10 a point, 7 green, 3 blue.	1) with tube: 12 a point, 7 white, 6 blue 2) with't tube: 11 a point, 8 green, 4 blue
22 yellow or white, 14 yellow, 6 white, 3 yellow.	22 a point, 14 white or yellow, 7 yellow.	22 a point, 17 yellow and remains so.	22 yellow.	22 white, 12 yellow, and remains so.	22 yellow, and remains so.	1) with tube: 22 white, 14 yellow. 2) with't tube: 14 green, 7 yellow? 5 yellow?
22 a point, 20 orange or red, 12 orange or yellow, 8 orange.	22 a point, 19 orange? 11 orange.	22 a point, 16 orange?	22 orange.	22 red, always red, 2 orange.	20 a point, 15 red, and remains so. 2 orange.	with tube: 16 red, and remains so. 3 orange, 2 yellow.
22 a point, 17 perhaps orange. 6 nothing sure, 4 white, 2 violet.	22 a point, 14 violet? 4 violet?	10 a point, 7 violet and remains so.	22 a point, 14 violet?	16 a point, 4 white, 1 blue.	15 a point, 5 white, 2 blue.	with tube: 22 a point, 8 white? 4 red, 2 violet.

provement of acuteness of color-perception by binocular vision was observed.

The distance of 22 *m.* was not large enough to test pigments of 2 *mm.*, as Dr. Strurve at this distance, saw Red as Red, Yellow as Yellow, and Orange and Orange; Violet, 1 *mm.* he saw at 7 *m.*, 2 *mm.* at 14 *m.* as distinct Violet; Blue, 1 *mm.* at 8 *m.*, 2 *mm.* at 17 *m.* as Blue; Green, 1 *mm.* at 9 *m.*, 2 *mm.* at 21 *m.* as distinct Green. Hence further observations in larger spaces than were at my command are to be undertaken to answer the question whether double-sized pigments can be seen at double the distance.

Some experiments *without* Weber's tube (see last column Table II) showed that Green, Blue and Yellow were seen at a shorter distance than with the tube; in the case of Red, the difference was scarcely worth mentioning.

In comparing the average figures as found for electric and sunlight, we have approximately:

TABLE III.

	ELECTRIC LIGHT.		SUNLIGHT.	
Red .	as Bright 16 *m.*,	as Red 13 *m.*	as Bright 19 *m.*,	as Red 14 *m.*
Green .	" " 22 "	" Green 11 "	" " 27 "	" Green 10 "
Blue .	" " 9 "	" Blue 3 "	" " 18 "	" Blue 6 "
Yellow	" " 18 "	" Yellow 4 "	" " 37 "	" Yellow 9 "
Orange	" " 24 "	" Orange 5 "	" " 28 "	" Orange 6 "
Violet .	" " 12 "	" Violet 2 "	" " 20 "	" Violet 2 "

It follows from that, that by electric light as well as by sunlight, *Red and Green are recognized with accuracy at a much greater distanre than* 5 *m.* Blue and Yellow were accurately recognized in electric light, not so far as 5 *m*, in direct sunlight farther than 5 *m;* Orange in electric light as far as 5 *m.*, in sunlight 6 *m;* Violet in both lights only seen accurately as Violet at 2 *m.*

I add by way of supplement that I examined in July last in the Zoölogical Gardens in Breslau, by direct sunlight and with the same apparatus, the quantitative color-sense of four Nubians, whose fine sense of color I had already tested (*Centralbl. für Augenhlk.*, July, 1879). There was no con-

versation during the examination; to each Nubian a quantity of worsteds was given, from which he showed each time the one corresponding with the color of the spot of 1 *mm.* held up for the test. I made one hundred and four tests, so as to draw the surest conclusions. The distances in meters were:

	BASELIER.	ACHMET.	MACHMUT.	MUKTAR.
For Red . .	19, 21, 18, 20, 22, 24, 24, 24, 25. 24.	24, 26, 25, 20, 27, 33, 33, 27, 24. 20.	18, 19. 19, 21, 20, 21, 21.	18, 18, 13, 16, 18.
For Green .	22, 24, 23, 22, 24.	18, 19, 24, 18, 15.	20, 20, 23, 22, 19, 29.	14, 18, 14, 14, 16, 15.
For Blue .	24, 17, 22, 17, 16, 21, 23, 24.	19, 12, 13, 13, 13.	20, 26, 27, 24, 23.	12, 13, 14, 16, 12.
For Yellow .	23, 24, 24, 24, 20, 21, 24, 20, 23. 23.	20, 19, 20, 18, 18, 14.	20, 26, 20, 23, 24, 24.	15, 16, 16, 12, 13.

The Nubians therefore saw, on an average, Red to 22 m, Green 19 m., Blue 18 m., Yellow 20 m.; they are therefore superior to the Europeans not merely in S. but also in the quantitative sense of colors.

ON THE REMOVAL OF FOREIGN BODIES FROM THE EYE. WITH FOUR CASES.*

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In considering the subject of foreign bodies within the eye, we naturally make certain sub-divisions, with reference to the locality of the foreign body, to that part of the eye in which the particle lies or is embedded. This seems to be the point of greatest importance, both in regard to prognosis and to the steps to be undertaken for its removal. Though at one time in the history of ophthalmic surgery it was quite customary to attempt the removal of a foreign body from the eyeball, without much reference to its locality, yet there subsequently came a reaction which ran to as great an extreme in the other direction. During the past ten or twelve years the pendulum of surgical opinion has swung back on its path somewhat away from this last extreme, and we now operate and attempt to remove foreign bodies from the eye in many cases which a few years back we should not have touched. Though our statistics upon this class of cases are hardly sufficiently full as yet to admit of the formulation of a rule as to operating, yet there are certain points which already seem in a fair way to be settled. From the reports of cases it appears that where the presence of a foreign body is suspected, though the particle itself is not seen, an attempt at probing for it, even when in the vitreous, may not do any harm and may almost be justifiable. When such a search has failed of any result,

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and we have reason to fear that the body lies in the vicinity of the ciliary muscle and processes, or perhaps anywhere in advance of the equator of the eye ball, the question of an operation for its removal should be seriously considered before enucleation is resorted to. These attempts at removal, by opening the eyeball at some point opposite the wound of entrance, are of course more promising where the media are sufficiently clear to admit of an ophthalmoscopic examination.

When a foreign body is seen in the lens or is suspected to be there, the question of its removal depends much upon the extent of clouding or swelling of the lens. Cases are on record in which a foreign particle, usually of metal, has remained encapsulated within the lens for years, surrounded by a localized opacity, while the rest of the lens has remained partially or entirely transparent. In such a case non-interference may perhaps seem the best plan, though it should not be forgotten that the foreign body may become at some later period disengaged from its surroundings, and either drop to the bottom of the lens by force of gravity, or may perforate the capsule, fall into the vitreous, and find a lodgement upon the ciliary processes, where it is sure to cause destructive inflammation within a very short time, and necessitate the removal of the eye.

If the foreign body is in the iris, or at the bottom of the anterior chamber, there is no hesitation in saying that its removal should be attempted at once. If the latter is the case, the anterior chamber should be opened below, either by a lance knife or Graefe's narrow knife, and the foreign body seized and withdrawn. With care this may be done and the operation completed without the need of an iridectomy. If the particle is embedded in the iris, it is better to excise the sector of iris containing it, either at once, or subsequently to the removal of the particle, as there is less danger of severe inflammation from an incised iris than from a lacerated one.

If the foreign body has perforated the eyeball and has lodged in the posterior half of the globe, and can be seen with the ophthalmoscope embedded in the retina, there

may be considerable doubt in regard to any attempt at its removal. Cases are on record where such bodies have remained encapsulated in the retina or choroid for years without causing any trouble except the scotoma in the visual field corresponding to their position. There seems to be a marked freedom from irritability in this part of the eye, which justifies us in feeling less alarm for an eye where the foreign body is situated in the retina, than when the particle lies more anteriorly. Dr. Knapp has very justly said that "the cases of successful or partially successful removal of foreign bodies from the vitreous chamber and its surrounding walls are so rare, that they may be considered almost as exceptions." Hence when such a case of a foreign particle lying in or upon the retina, encapsulated or not, is met with, it is perhaps better to leave it alone and content ourselves with keeping tne case under observation. One reason for the lack of success in the removal of these particles from the vitreous no doubt lies in the fact that very often they cannot be seen, nor can their location be determined owing to the opacity of the vitreous or other media, resulting from the intraocular inflammation.

It is not the intention of the writer to give here any detailed historical account of the subject, the literature of which has already obtained respectable dimensions. He would simply refer to the excellent papers of *Berlin* in the *Archiv für Ophthalmologie*, Bd. xiii and xiv; to *Knapp's* articles in the *Archives of Ophthalmology*, vol. vii and viii; and to the report of a singular case by *von Jaeger* in the *Archives of Ophthalmology*, vol viii, No. 3.

The following four cases of foreign bodies in the eye, in all of which the particle was removed and the final result was successful, were under the writer's own care and observation. Each of the four represents a different injury, both as regards the location of the foreign body and the severity of the damage done.

CASE I.—*A piece of copper shell from a pistol embedded in the cornea and projecting into the anterior chamber.*

Patient was a boy, W. D., æt. 9, who, four days before I saw

him, had been wounded in the right eye by the explosion of a small pistol. When first seen, there was a ragged wound in the cornea, just below and to the nasal side of the centre, with an extensive zone of purulent infiltration around it, involving nearly a third of the diameter of the cornea, but no foreign body was visible. There was a layer of coagulated blood at the bottom of the anterior chamber, and above this was a stratum of pus. The pupil was contracted and only slightly movable, but there was no exudation into the field of the pupil, and no cataract visible. The iris did not appear to have been wounded, though of course the infiltrated cornea prevented an accurate examination. The circum-corneal injection, superficial and deep, was very marked, and the boy complained of severe pain. The presence of a foreign body was suspected in the eye, but it was thought that as there was no apparent wounding of the lens or iris, the particle might have penetrated the cornea and dropped into the anterior chamber, and that it was probably at the bottom covered by the blood and pus. It was decided to attempt nothing in the way of an operation, but to direct the constant use of hot water and atropia, with opium to relieve the pain. The tension was reduced. T — 1, and the boy had only perception of light.

On the fourth day after his visit, the eye was looking better. The hypopyon had all disappeared, the blood in the anterior chamber was almost entirely absorbed, and the lower part of the cornea so clear that it was evident that there was no foreign body lying at the bottom of the anterior chamber. The pupil was dilated and the lens perfectly transparent. The central corneal infiltration had diminished somewhat, and by strong oblique illumination a glistening piece of metal could be seen projecting from the posterior surface of the cornea toward the lens. Its point was very sharp, and protruded so far backward into the anterior chamber that it almost touched the capsule, and with an undilated pupil and in full accommodation, it must have scraped against the iris. The iris was no doubt slightly lacerated at the time of the injury, which accounted for the blood in the anterior chamber. The capsule was fortunately not injured, owing to the interposition of the iris. The pain had ceased, and the ocular injection was less marked.

It was decided to attempt the removal of the piece of metal at once, and not to wait until it had worked its way into the anterior chamber, for in this process the lens might be wounded. The boy

was etherized, and the cornea transfixed by a rather broad Graefe's cataract knife, the point of entrance being made through clear cornea on the temporal side of the foreign body, and the point of exit through clear cornea on the nasal side of the foreign body. The blade of the knife was then pressed firmly against the end of the metallic splinter, and thus the latter against the cornea, while the knife also served as a means of fixing the eyeball. The wound made by the exploded shell was then carefully enlarged with a broad needle, working upon the blade as a foundation, until the bit of copper could be seen. The needle was then discarded, and the foreign body seized with a pair of transversely grooved dissecting forceps with fine blades, and after some little difficulty removed. During the latter part of the operation, just before the removal of the piece of metal, a whitish exudation was seen upon the capsule of the lens, which rapidly extended till it overspread the entire field of the pupil before the knife was withdrawn from the cornea.

When this last step was taken, atropia was instilled and the eye bandaged. At the end of six hours the bandage was removed and the eye opened, and the iris was found adherent to the cornea, not at the central laceration, but at the wounds of entrance and exit of the knife. Atropia was then instilled every hour until the toxic effect of the drug compelled its discontinuance. On the next day the synechiæ were broken, the pupil was widely dilated, and the exudation had entirely disappeared from the capsule. This latter accident I had never before observed, but in one of Knapp's cases (*Archives of Ophthalmology*, Vol. vii, Nos. 2, 3 and 4, p. 313) the same thing was noticed, and it vanished on the next day. The boy was discharged on the third day, and on the tenth day almost all signs of corneal infiltration had disappeared and his vision was $\frac{20}{XL+}$

CASE II.—*Piece of iron in the anterior chamber. Traumatic cataract.*

The patient was a man, P. F.. æt. 67. He was struck in the right eye two days before I saw him by a piece of a nail-head, which had been chipped off in striking it with a hammer. There was a perforating wound of the cornea near the lower region, about 2''' long, a small prolapse of the iris, the anterior chamber was about half full of blood, and there was a traumatic cataract.

The eye was not markedly injected, but the tension was slightly increased, and there was considerable pain. There was a strong probability of the foreign body being in the eye, but it could not be seen. Atropia and cold applications were ordered, and the patient was directed to keep perfectly quiet. The other eye had been injured some years before, and the vision was defective from an opaque spot in the cornea, being only $\frac{20}{100}$. Vision in the right eye was reduced to distinguishing the movements of the hand.

On the third day after I first saw him, and on the fifth after the accident, the blood in the anterior chamber had become entirely absorbed, and a better view could be obtained of the parts behind. The prolapse of the iris had been diminished by the atropia, and the iris was found lacerated, the capsule opened and soft opaque lens matter oozing through the opening. In the bottom of the anterior chamber was a small piece of black metal, partially embedded in the prolapsed iris. The pain still continued, and it was decided to attempt the removal of the foreign body. The corneal wound, being almost in the limbus, was enlarged, the lacerated and prolapsed iris drawn out as far as possible, and a large piece excised, leaving a broad coloboma downward and outward. A strong pair of iris forceps was then introduced, and after two unsuccessful efforts the foreign body was seized and extracted. It was followed by some lens matter and a little blood. After waiting a few minutes the capsule was opened freely parallel to the wound, and then by pressure and counter-pressure on the eyeball the soft cataract was slowly squeezed out, though a considerable part of it remained behind, and could not be extended. Atropia and a double bandage were then applied, and the case watched with great anxiety. Violent iritis followed, with partial blocking of the coloboma by exudation, and the cornea became infiltrated. The inflammatory action was so violent that the bandage had to be removed, and hot fomentations, atropia and leeches, were employed. The inflammation slowly subsided, the cornea became clearer, and the pain almost ceased. But at the end of six weeks it was seen that a general atrophy of the globe was to be the final result. The coloboma became clear in part, so that at present there is a vision of $\frac{10}{200}$, but the process having involved the ciliary body, the man cannot hope to retain the amount of vision at present possessed. At no time were there any symptoms of sympathetic trouble in the other eye, though this was feared from the beginning.

CASE III.—*Piece of iron in the iris and lens. Traumatic cataract.*

The patient was a man, J. S., æt. 45, who, six hours before I saw him, was struck on the left eye by a piece of iron from a chisel, struck by a large sledge in the hands of a fellow workman. When I saw him there was some swelling of the lids, injection and chemosis of the ocular conjunctiva, great intolerance of light, but not much pain. There was a ragged wound through the cornea just below the centre, the lips of which were distended by prolapsed iris, blood-clots and some soft lens matter. There was scarcely any anterior chamber, and the surface of the iris was covered with blood. It was thought that a foreign body of some sort could be seen embedded in the iris and lens, and through the part of the pupil that was visible, the lens was seen to be opaque. The iris was pushed forward by the swollen lens behind it, as well as drawn forward by the prolapse. The tension was slightly below normal.

The case seemed to demand immediate interference, in the hopes of saving some vision to the eye. The wound of the cornea, which was an irregularly rectangular laceration, would be in great danger of suppurating, especially if there was much pressure from behind. The prolapsed iris was therefore excised, and the lips of the wound separated, so that by pressure on the ball the soft lens matter might be squeezed out. After this had been done, and the iris partially replaced, a black point was seen projecting from the iris toward the cornea. The wound in the latter was then enlarged down to the limbus, and an attempt made to grasp the foreign body with a small pair of dissecting forceps. This failed, and the curette was then introduced and passed beneath the body, which it lifted out of its bed in the torn iris, and the curette was then withdrawn, still holding the foreign particle. This proved to be a rough scale of iron, somewhat pyramidal in shape, about $\frac{3}{16}$ of an inch long by $\frac{2}{16}$ of an inch broad, with its base projecting towards the cornea. The rest of the cataract was then extracted by means of pressure and a Daviel's spoon, and all ragged points of iris tissue cut off smooth. Atropia was instilled and both eyes bandaged.

In spite of the severity of the injury there was no violent reaction. There was some pain, which was relieved by frequent instillations of atropia, but the case did well from the beginning.

The iris became adherent to the corneal cicatrix, and there is now practically no anterior chamber. The tension has remained below normal, though the wound in the cornea has entirely closed. There is no pupil, but there is opportunity for an iridectomy inward toward the nose, which will give him useful vision. The field and projection are apparently uninjured.

The case has turned out very satisfactorily, and was a fortunate one from the start. The man was seen within a few hours of the receipt of the injury, the foreign body and cataract both removed, and absolute quiet enjoined and strictly followed out. Moreover the ciliary region was not injured, nor had the vitreous humor apparently been involved by the foreign body.

CASE IV.—*A piece of steel in the vitreous.*

The patient was a man, J. F., æt. 53, a cooper by trade, and was first seen by me Sept. 1, 1879. A few hours previously he had been struck on his right eye by a piece of metal from a hammer, as he was engaged in driving a hoop upon a barrel. The resulting inflammatory process had been very rapid, for there was hypopyum, iritis, a small amount of blood in the anterior chamber, and a slightly cloudy cornea. There was a small wound through the sclera in the upper equatorial region, extending backward for perhaps a quarter of an inch very nearly in a line with the inner margin of the superior rectus muscle. Through this wound the vitreous projected. There was no wound in the upper lid of any kind, and it was difficult to see how the foreign body could have entered the eye in this region without perforating the lid. There was no reflex from the fundus, so that the vitreous was probably full of blood. Vision was reduced to faint perception of light.

It was decided to delicately probe the wound in the sclera, which was done with a fine silver probe bent upon itself, but though the immediate vicinity of the wound was carefully examined in every direction, nothing was discovered.

Atropia and a protective bandage were ordered. Two days later the pus had disappeared from the anterior chamber, the pupil was irregularly dilated, mainly upwards; floating blood-clots could be seen in the vitreous, and in the upper and inner quadrant of the lens was a small opacity. A bead of vitreous

Since the paper was written an iridectomy has been done inward, which has given him a vision of $\frac{20}{50}+$, nearly $\frac{20}{40}$.

humor was still projecting from the wound. On the next day there was a general haziness of the vitreous, as of a general hyalitis, but an indistinct view was gained of the optic disk. There was no pain and no signs of any sympathetic irritation. On Sept. 5th there was severe pain in the eye, but the other symptoms were about the same, and V. $=\frac{5}{100}$. The case progressed about the same until Sept. 12th, when there was observed a tendency to prolapse of the vitreous through the wound, and the bandage was reapplied. On Sept. 19th a very careful and rather protracted examination of the fundus was made, but nothing was found. The vitreous was slowly cleaning up, the opacity in the lens had not extended, and the ocular injection was disappearing. The scleral wound was still open ; with convex 10 spherical, V.$=\frac{20}{200}$.

On October 8th, thirty days after the injury, on examining the wound which was still open, I was tempted to use the probe again, and had scarcely introduced it into the opening when it struck against something hard. It was immediately withdrawn, and a foreign body then presented itself at the wound. A pair of small grooved dissecting forceps was introduced, and after several failures, the body was grasped and withdrawn. It had contracted adhesions to the vitreous and retina and no doubt was about to become encapsulated, and hence was removed with some little difficulty. It proved to be a piece of steel from the hammer, sharp at one end, and about one-fourth of an inch long. No bad results followed the removal of the foreign body, and the eye has steadily improved, so that at the last examination V. $=\frac{20}{40}$, with a prospect of still further improvement. The patient has informed me that the vision in the injured eye was always defective, owing to an inflammation which occurred in childhood, and he thinks it is as good now as it ever has been. This case was exhibited before the New York Ophthalmological Society at its meeting in October, 1879.

ADDENDUM.

A CASE OF SUPPOSED AMBLYOPIA FROM QUININE POISONING REPORTED ON P. ——

By Drs. ROOSA and ELY.

WHEN the report of the above case was already in press, we found that Dr. A. H. Voorhies, of Memphis, Tenn., and Dr. L. De Wecker, of Paris, had recently made valuable contributions to this subject.

The following extracts are from the report of a case published by Dr. Voorhies in the *Transactions of the American Medical Association* for 1879, p. 411:

"February 16, 1878, I was asked to see Miss V. H., a young lady, aged 18, living on the Arkansas side of the Mississippi. * * * I found the patient in bed, with every appearance of being extremely ill. * * * One week before the date of my visit, under the apprehension that this lady was threatened with a congestive chill, a relative (not a physician) caused an ounce of quinine to be administered to her within the space of a few hours, and that a like quantity was given each day for the two following days. In other words, more than 1,300 grains were given by stomach and rectum within three days. On the morning of the second day it was discovered that she was perfectly blind. * * * Audition was but slightly impaired. * * * There was marked paleness of the face, and this was also noticed in the conjunctival lining of the lids. Pupils normal, responding promptly to light. T : 1 ; anæsthesia of cornea so as to suffer a probe moved over its surface without complaint. No perception of light. Ophthalmoscopic view very peculiar; disk perfectly white; not a trace of optic nerve vessels—neither veins nor arteries; choroidal vessels empty, with pale yellowish tinge of retina."

Nitrite of amyl was used for four days without any apparent effect. Strychnine was then given hypodermically. * * * "But still no improvement of sight was discovered until the middle of the tenth week, when she was able to discern a trace of light on the use of the ophthalmoscope. The return of light was very gradual, until she was, and is now, enabled to read Jaeger No. 1. I had the opportunity of examining this case a few days ago, and find the disk perfectly white, with still no trace of central artery except a small twig, which is just perceptible as it struggles over the upper half of the disk of the left eye, to be lost on reaching the retina. The field of vision is greatly contracted, and * * * I find the greatest, which is the vertical diameter, to be less than four inches when taken at two feet. Her general health is good, and her mental activity is fully restored."

The following is extracted from Dr. Wecker's recent work *

"Intoxication by *quinine* is extremely rare. You have seen here a young patient, who, having contracted intermittent fever in the tropics, determined to cure himself. He filled a large glass for about an inch with quinine, swallowed it all, and went to bed. He awoke both deaf and blind. Hearing and vision eventually returned, but the latter imperfectly. For though central acuity was normal, the visual field of each eye showed a peculiar symmetrical lacuna. There were in both visual fields, islands of blindness; the larger of the two occupied a considerable portion of the internal half of the field, and extended samewhat beyond the point of fixation; the smaller affected merely a small external portion. In these rare cases, so far as my experience goes, vision has returned incompletely, and I have never seen absolute blindness caused. * * * "

* Ocular Therapeutics. By L. De Wecker. Translated by Litton Forbes, M.D. London, 1879.

NOTE TO THE CASE OF RIGHT-SIDED BINOCULAR HEMIOPIA, DEPENDING UPON A GUMMY TUMOR IN THE LEFT POSTERIOR LOBE OF THE BRAIN.

By Dr. T. R. POOLEY, of New York.

IN number 2, vol. v, of these ARCHIVES, I published a case of hemiopia, with a post-mortem, and promised to report at some future time the result of the microscopical examination of the tumor and specimens taken from other organs. This promise, which, through my inadvertency, has been so long delayed, I now fulfill.

The examination was made by Dr. Adolf Alt, now of Toronto, but at that time Resident Surgeon and Curator of the N. Y. Ophthalmic and Aural Institute.

Over the tumor of the brain the meninges are much thickened by new formation of fibrous tissue. The tumor itself is made up of round cells of various size, between which there is a small amount of hyaline matrix, not very different from myxomatous tissue, in which some long-stretched elements of connective tissue can be found.

While in the tumor itself there are no vessels to be found, its surroundings are very vascular.

These vessels show the following remarkable changes: Their walls, especially those of the capillary walls, are very much thickened, and transformed into a hyaline mass. This thickening is very frequently so far developed as to entirely close the lumen of the vessel. In this hyaline mass some small, fatty granules are scattered about. One of the larger vessels also shows the atheromatous changes to a marked degree. It is surrounded by the remnants of an old con-

siderable hemorrhage, which is situated posterior to the tumor.

No new elements any longer exist in the tumor.

The mass of the brain around the tumor exhibits in a marked degree the so-called yellow softening.

Not only is the marrow of the nerve fibres in a state of fatty degeneration, but there is also a large amount of fatty detritus.

The indurated parts of the apices of the lungs show the changes produced by chronic parenchymatous and interstitial pneumonia.

This induration is caused by the new formation of very dense connective tissue, which is pigmented in the ordinary way, and encloses some small heaps of round cells and fatty detritus.

The stellate scars of the liver, which are very vascular, are formed, in the same manner, of dense connective tissue, which is in connection with the thickened capsule of Glisson. Between the fibres of connective tissue there are remnants of liver cells in a state of fatty metamorphosis. The parenchyma of the liver, as a whole, is in the beginning stage of fatty degeneration. As is always the case, the periphery of the lobuli exhibits the process of metamorphosis to the most marked extent.

There is no amyloid degeneration.

Anatomical Diagnosis.

Syphilitic induration and fatty degeneration of the liver; chronic parenchymatous and interstitial pneumonia; gumma of the left posterior lobe of the brain; atheromatous arteries, hemorrhage in the brain, and serous exudation into the right lateral ventricle.

GUN-SHOT WOUND OF BOTH EYES. ABSORPTION OF LEFT CRYSTALLINE LENS. RECOVERY.

By Dr. J. SANTOS FERNANDEZ, of Havana.

THE case I am about to relate presents many interesting points. It refers to a man who received a discharge of shot on the face from a gun fired only a few feet distant. The right eye, in spite of the damage occasioned to the cornea, iris and lens, atrophied without causing any trouble. The corresponding parts of the left eye were also injured; the cornea presenting a central perforation, or at least such was the supposition entertained by the existence of a deep ulceration, absence of anterior chamber and softening of the crystalline lens; the latter, soft and opaque, was ultimately absorbed without any inflammatory or painful phenomena.

It is well known that capsular wounds imply the agency of sharp and lacerating bodies, or of small foreign bodies, in which latter case they may be found in the anterior chamber, crystalline lens, or vitreous body; a supposition which is all the stronger when the softened lens is almost entirely in the anterior chamber, although solutions of continuity of the capsule may also result from sudden compression of the globe. In the case under consideration such compression could not be effected by a few shot; but some of these must have perforated the cornea and wounded the capsule of the lens. And, if such was the case, and to it was due the passage of the opaque lens into the anterior

* Translated from the Spanish manuscript, by Dr. A. B. DeLuna, of New York.

chamber, what became of the foreign body? Was its passage into the vitreous possible? These are interesting questions, since its absence from the anterior chamber and crystalline lens could be easily demonstrated after the absorption of the latter? All of us know that particles of glass, metal, wood, lead and steel have been seen in the vitreous body, which has also occasionally tolerated in its midst the encysted foreign body, not only with impunity, but with such re-establishment of the transparency of the vitreous humor as affords tolerably good sight. Unfortunately these are exceptional cases, for oftener either a true abscess forms, producing complete opacity of the vitreous humor, or the cellular tissue which organizes forms adhesions with the ciliary body and the retina, the consequent retractions bringing about the separation of the latter, or the atrophy of the bulb through disorders in the former. When the introduction of the foreign body is immediately followed by active inflammation, the end is even more disastrous, for an abscess with its concomitant sufferings is not long delayed.

Mr. R. P., æt. 32 years, and the patient in question, is a native of Cardenas, province of Havana. He is not over strong in constitution, of a nervous temperament, and belonging to a family of tuberculous and neuropathic proclivities. An enthusiastic sportsman, he was very expert in the use of fire arms, though on more than one occasion he had suffered from the carelessness of his hunting companions.

On the morning of June 9, 1879, and while hunting with an attendant, from whom he was separated about six metres, a bird flew between both, at which the latter thoughtlessly discharged his piece, wounding Mr. P. in the mouth, left cheek and hand, and both eyes. The passage of the shot through the hat worn by the patient indicated that the gun was fired in front and to the left of him, the more serious injury to the right eye being due to his partially protecting the left with his hand at the time.

Bleeding and blind he was taken to Dr. Oxamendi's house. The lids, perforated by the small shot, presented, however, no wounds of great extent, and the wounded corneæ of both eyes maintained their transparency until dusk, when opacity was first

noticed in the region of both lenses. When I saw him the following day, both lids were closed and swollen, and by carefully separating them, the globe of both eyes could be seen, fixed, and presenting marked peri-corneal chemosis, greater on the right side, and threatening strangulation of the corneæ. In the right eye the cornea was perforated through the centre, and almost through its whole extent; there was no anterior chamber; the iris was lacerated, especially in its internal two-thirds; the crystaline lens was opaque, and as if divided in two sections; there was hardly any perception of light; and absence of pain and photophobia. In the left eye there was a central corneal perforation of about three or four lines in extent, probably the point of entrance of a small shot; the anterior chamber was wholly occupied by the softened substance of the lens; there was good perception of light; no pain; very slight secretion of tears; photophobia, and slight increase of intra-ocular pressure. The gravity of the case, and the absence of very active inflammatory symptoms at the time, rendered expectancy necessary, and prognosticating the loss of the right eye, and the threatening condition of the left, due to the presence of the lens in the anterior chamber, I contented myself with the careful use of atropia and mercurial inunctions to the forehead and temples. The general condition of the patient was good, and the terrible calamity that threatened his eyes certainly was not apparent from his resigned and at times cheerful mien.

Three days after the accident he was taken to his home in Cardenas, and I then found no tumefaction of the lids, a very slight decrease in the distension of the left anterior chamber, and some motion in both eyeballs. The atropia in the right eye was continued, and for the left the alternate use of the neutral sulphate of duboisia and the chlorhydrate of pilocarpia.

The patient was brought to Havana on June 20th, when a consultation was had with Drs. Hortsman, Finlay and Montaloo, the chemosis at the time having disappeared in the left, and diminished considerably in the right eye, though the other symptoms remained unchanged. That the right eye was lost, and should be enucleated without delay, was unanimously conceded; while the presence of a stray shot was suspected in the interior of the left, and the extraction of the cataract agreed upon as soon as the peri-corneal congestion would allow it. The internal use of phosphorus was then prescribed.

On the 25th, fifteen days after the accident, indications of absorption of the lens were first noticed, and became more and more marked, and on July 20th the disappearance of the cortical substance, the better perception of light, and the fact that the right eye presented unmistakable evidences of atrophy, led one to enucleate the latter, which was accomplished without accident of any kind.

The microscopical examination of the extirpated eye revealed the substitution of a muco-purulent fluid for the vitreous humor while the cavity of the latter with its external and internal lining membranes appeared contracted. Some irregularities on the sclerotic surface near its point of union with the cornea, and toward the external and superior regions could be detected by the touch, and a careful section of that membrane at said point revealed in its substance the bluish marks characteristic of the passage of small shot through the tissues, which marks had also been observed in the conjunctiva and cornea of both eyes. The presence of a foreign body in the interior of the eye seemed certain. But the most careful search could not reveal it.

After the operation the absorption of the remnants of the lens in the left eye appeared to progress with greater rapidity, and mercurials were ordered as alteratives. Toward the last of July hardly a point remained on the internal surface of the cornea, on the level with the perforation; but still the bottom of the eye could not be lighted up with the ophthalmoscopic reflector, and by oblique light a sort of capsular opacity could be perceived over the whole posterior portion of the region of the lens. No change in the peception of light.

On August 15th, the patient declared he could see a lighted candle more distinctly, but the ophthalmoscopic examination was negative and the interior of the eye could not be seen. A few days after however, on insisting that he could see his hand and also persons crossing the room, he was again examined and I thought I could distinguish, although imperfectly, the reddish aspect of the interior. A few days after, I had no doubt about it, and on September 14th, it could be so illuminated with the ophthalmoscope that the retinal vessels would probably have been brought to light, had it not been for the central leucoma due to the perforation of the cornea. The visual acuteness was still imperfect, he could count his fingers and with a No. 3 lens could see letters 0.027 *m.* one decimeter distant. On the 24th he returns to

the country, and although he begins to walk unassisted, he cannot steer clear of objects in his way. The mercurials in alterative doses and the local use of atropia are continued.

October 7th.—Returns from the country by himself, walks around without trouble, and although he seems to recognize people, often mistakes them, not being able to distinguish the color of their eyes. Wears convex glasses, 9 dioptries. At a short distance, and with glasses such as are used after the operation for cataract, (18 dioptries), his visual acuteness is only $\frac{1}{12}$. The ophthalmoscope reveals the bottom of the eye free from lesion, although the examination is rendered difficult, by the central opacity of the cornea and a synechial filiform band extending from the inferior border of the pupil to the internal or posterior surface of the corneal opacity above mentioned.

October 14th.—Returns to the country with instructions to resume the internal use of phosphorus, and the local application of mydriatics, and should the latter make no impression on the anterior synechia, I anticipated the necessity of discission.

Dr. Arlt,* of Vienna, speaking of wounds of the crystalline lens says: "In a general way we may consider all wounds of the lens as seriously threatening the existence of the eye, not only from the simultaneous lesions of surrounding structures (cornea, iris, and ciliary body), and frequent penetration of foreign bodies back of the lens, but on account of the compression of the cornea, iris, and ciliary body by the crystalline lens. This terrible accident is very soon followed by rapid distention of the lens from imbibition of the aqueous humor, and finally resulting in luxation of the wounded lens. An eye thus injured is exposed to inflammatory action with fibrino-plastic or purulent exudation leading to destruction; while should it escape atrophy, and the lens is absorbed after a period of intense suffering, inevitable blindness will often follow as the result of glaucomatous excavation of the optic nerve, or diffuse choroiditis with retinal atrophy.

"While the extra-capsular portion of the crystalline substance, which almost always lies in the lower part of the

* On wounds of the Eye from a Practical and Med. Legal point of view. Chap. 11, p. 88.

anterior chamber, is being absorbed, the eye presents a state of irritation often leading to a true iritis, and characterized by great ciliary redness, epiphora, photophobia, etc.

"As new portions of the lens advance toward the wound, the equatorial diameter lessens though a cure cannot be obtained, until the whole substance is expelled and absorbed. Generally after complete absorption, the anterior capsule adheres to the posterior, forming a septum of more or less thickness that separates the vitreous from the aqueous humor; said septum generally containing between its layers a certain amount of crystalline substance more or less changed. If the patient, however, has passed his twenty-fifth year and the lens consequently possesses greater consistency, complete absorption is not possible."

HAVANA, *January.* 1880.

ON THE DIVISION OF THE OPTIC AND CILIARY NERVES.

By H. KNAPP.

I HAVE hesitated long in performing the operation of optico-ciliary neurotomy, which during the last four years has received so much prominence in France and Germany, and lately also in America.*

As others, I was in doubt about the efficacy of this operation in preventing sympathetic ophthalmia. I was not afraid of the danger of the operation from hemorrhage, suppuration in the orbit and sloughing of the globe, for several extirpations of the optic nerve, with preservation of the eyeball, which, since June 1874, I have done, and one which I assisted Dr. Grüning in performing, October 1875, had convinced me that the nutrition of the eye will not seriously be interfered with by a mere division of the optic and ciliary nerves, an operation less extensive and much easier of execution than the removal of optic nerve tumors without previous enucleation of the globe. I did not doubt the possibility of dividing all the ciliary nerves, as in Dr. Grüning's operation, in which the tendon of the internal rectus had unintentionally been detached, the posterior segment of the globe, after the division of the optic nerve, turned straight forward, so that all connections which it formed with the tissues contained in the muscular funnel

* The history of this operation may be read in a critical review by Hirschberg, *Centralblatt für Augenheilk.* ii, p. 129, etc., June, 1878, and in a paper by Warlomont, *De l'Enervation du Globe de l'Oeil. Annales d'Ocul*, tome 82, p. 223, etc.. Dec., 1879. Most instructive are D. H. Schöler's papers (*Jahresbericht seiner Klinik*, 1877 and 1878); 35 cases.

could be directly seen and cut. The globe was kept replaced in its ordinary position by a suture uniting the wound. The operation was somewhat tiresome and required a good deal of cutting; yet the recovery was rapid, perfect and permanent, for some months ago I had an opportunity of again examining this eye, and found that there was no other disfigurement than slight divergence. The retina and choroid were atrophied.

About another question, however, my misgivings have not yet been entirely removed, namely, will not some of the severed nerves reunite? That this takes place in other nerves is well known. In cases of facial neuralgia I have seen that the infra-orbital nerve was not only divided, but portions of it from 2 to 4''' in length were exsected, and yet after six months the tic douloureux had returned in all its previous violence. The reunion of the severed ciliary nerves may, perhaps, not occur, since after the operation the optic nerve, with all the surrounding tissue, is drawn toward the optic foramen, thus creating a free space between the posterior wall of the globe and the proximal ends of the severed nerves. This retraction is very great after enucleation of the globe. When the globe is not removed, the principle forces which draw the orbital tissue toward the apex of the orbital pyramid, the recti muscles, retain their natural situation and functions, obviating an extenssive retraction of the optic nerve and its surrounding tissue. Whether the fear as to the possible reunion of the ciliary nerves is founded or not, will be decided by further experience. The future will show whether optico-ciliary neurotomy prevents the outbreak of sympathetic ophthalmia permanently or not. I shall watch the cases that fall under my notice, not only in this respect, but also test the sensibility of the cornea; 1st, shortly after the operation, in order to ascertain whether or not the neurotomy was complete; and, 2d, months and years afterward, in order to see whether the nervous conduction has remained permanently interrupted or has in some degree been reëstablished.

Induced by the general favor into which optico-ciliary neurotomy seems to have grown lately, I performed, in the

last six weeks, this operation in three cases, on which I beg to offer some remarks. The first two were recent accident cases in children, the injury implicating the cornea, iris, lens and ciliary region. Both eyes, after the healing of the wound, preserved their shape, but were completely blind. In both cases I divided the internal rectus, and passed sutures through it and the overlying conjunctiva, loosened the conjunctiva from the sclera toward the cornea, as in the operation for advancement, divided the optic nerve with a pair of blunt-pointed scissors curved on the flat, rotated the globe and drew its posterior end forward with toothed forceps, divided all the tissues on the posterior part of the globe with the exception of the tendons of the two oblique muscles, replaced the ball, stitched the tendon of the internal rectus forward, in one case with three, in the other with four sutures, and covered the eye with charpie, held in position by a flannel roller. There had been very little hemorrhage during the operation, and none afterward. The cornea, in both cases, was insensible in its whole extent.

The recovery was undisturbed. The eyeballs protruded slightly during the first three days, and the lids and conjunctiva were somewhat œdematous. This began to subside on the fourth day. On the fifth the sutures were removed, and on the eighth the patients were discharged. At present, six weeks after the operation, there is in each case a divergence of about 1‴. Corneæ completely insensible.

Knowing from the extirpation of optic nerve tumors what large masses can be removed from behind the eye without detaching a muscle, I performed the next operation without myotomy in a way similar to the one which I pursued, in 1874, in the removal of a large endothelioma of the optic nerve,* which encompassed the whole posterior half of the eyeball. Standing behind the etherized patient, I made with squint scissors a meridional incision between the superior and internal recti muscles, severed the tissue between the muscles close to the sclerotic as far as the optic nerve, which I could feel with my little

* *Arch. Ophthalm. and Otol.*, iv, p. 323.

finger as well as with the scissors. After dividing the nerve, I had, with squint hooks, drawn the lips of the conjunctival wound asunder, the one up, the other down. Through this opening I introduced a small, sharp, double hook as far as the optic nerve, implanted the points into the sclerotic, and turned the globe completely round, so that the posterior half looked straight forward. Then I divided, with strabismus scissors, all the connections of the posterior half of the sclerotic with the orbital tissue, replaced the globe, waited a few minutes until the insignificant bleeding had ceased, and bandaged the eye with charpie and a flannel roller.

The patient was a girl of 13 years of age. The eye was lost from ophthalmia neonati, somewhat reduced in size, and had a partial, slightly bulging corneal staphyloma, which I intend to abscise later, in order to fit the ball for an artificial eye. A strip of vascular tissue extended from the upper part of the limbus in a curved line over the cornea down to the lower part of the limbus. On examining the eye immediately after the operation, and some weeks later, the strip of tissue always proved sensitive to the pricking of a fine needle, whereas the preserved parts of the cornea on the nasal and temporal sides were completely insensible. From this I inferred that all the ciliary nerves were divided, and that the vascular strip of tissue contained nerves derived from the conjunctiva. The healing of the wound was undisturbed, and the patient returned to her home seven days after the operation.

I think that this plan is the simplest, the least dangerous, and yet as efficient as any that have come to my notice. I return in this way to the first methods of performing this operation, according to which the nerves were divided without cutting any muscles (Rondeau, Boucheron, Dianoux). In these methods the posterior part of the eyeball was not turned forward, and some ciliary nerves may have easily escaped. Boucheron, appreciating this, recommended to draw, with toothed forceps, the posterior pole of the eye forward, so that the section of the optic nerve could be seen and the ciliary nerves surrounding it, surely cut. Yet

Boucheron, who, by suppuration, lost the eye he first operated on, did not adhere to this method, preferring to divide one of the straight muscles, "chiefly in order to give easy exit to the effusion of blood which might take place in the retro-ocular wound." I do not think that hemorrhage need be feared if the incisions are made close to the sclerotic in the manner described above, in which the muscles and the vascular tissue of the orbit are spared. It is easier to turn the eyeball with a sharp hook than with toothed forceps, as I have repeatedly convinced myself. Every one knows that the smooth and tight sclerotic is not easily grasped with the fixing forceps. Schweigger "draws with a small, sharp hook, implanted into the sclerotic near the optic nerve, the posterior pole of the eyeball forward," yet he performs tenotomy of the internal rectus first, and after the operation unites the muscle again with a catgut suture. To leave the divided muscle without a suture is, I think, not advisable on account of the subsequent squint. Why Schöler, Meyer, and the majority of operators prefer to divide the external rectus, instead of the internal, I cannot sufficiently account for. It is true that tenotomy of the externus leaves less deviation of the globe than tenotomy of any other muscle. Yet this disadvantage can partly be obviated by stitching the internal rectus forward. The inner side of the globe affords the easiest and nearest approach to the optic nerve; on the temporal side we have a longer path and meet on our way the insertion of the two obliques, which several operators were even obliged to divide. I think it is best to avoid all this, and execute the operation according to the earlier method of Boucheron, dividing no muscle, and drawing, as Schweigger does, the posterior pole forward with a sharp hook. In this, however, I prefer a double hook, since I imagine that it steadies the eye better, and rotates it more securely in the direction intended by the operator, without admitting of any irregular twisting or secondary rotation on an antero-posterior axis. Unless I am apprised of something better, I shall perform the operation of dividing the optic and ciliary nerves according to the procedure followed in the third case described above.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY FOR THE FIRST HALF OF THE YEAR 1879.

By Dr. H. MAGNUS, of Breslau, and Dr. A. NIEDEN, of Bochum.

Translated by Dr. R. O. Born, of New York.

I.—ANATOMY. By Dr. H. Magnus.

NORMAL ANATOMY.

1. Angelucci. On the structure and the development of the anterior portion of the uveal tract of the vertebrates. (*Centralblatt f. med. Wissensch.*, No. 24.)

2. Ayres. Contributions to the development of the cornea and anterior chamber. (*A. O.*, vol. vii, pag. 1.)

3. Van Bambeeke. Contributions à l'histoire du développement de l'œil humain. (*Annales de la Société de Méd. de Gand*, 1879.)

In the four-week-old fœtus the lens was not yet separated from the cornea, the vitreous without vessels, the limitans interna retinæ distinct.

4. Born. The nasal cavities and the nasal duct of the amniotic vertebrates. (*Morphol. Jahrb.*, vol. v.)

5. Boucheron. Sur les adhérences aponeurotiques des muscles droits avec la capsule de Tenon. (*A. d'O.*, Jan. and Feb., 1879.) Conf. These Archives, vol. viii, 3, No. 390 of the bibliogr. The posterior portion of Tenon's capsule extends to the equator, the anterior to the cornea. Extensions of the capsules which contain smooth muscular fibres pass from the equator to the basis of the orbit. Every muscle has two lateral attachments to the capsule and one anterior attachment forming an arch, the cavity of which is called the pre-muscular serous cavity. Between every muscle and the globe is a still larger retromuscular serous cavity; only the tendon of the muscle adheres to the globe.

6. DUVAL publishes (in *Gaz. hebd.*, 1879, No. 27) researches on the origin of the motor nerves of the eye in the ape.

7. GRENACHER. Examination of the visual organ of the arthropodes, especially of the spiders, insects and the crustaceæ. *Göttingen*, 1879, with 11 plates.

8. GRÜNHAGEN. On the central fibres of the oculomotor and the pupillary fibres of the sympathetic nerve after Hensen's and Völkers' experiments. (*Berliner Klin. Wochenschr.*, 1879. No. 27.)

9. GUDDEN. On the crossing of the optic nerve fibres in the chiasm. (*A. f. O.*, vol xxv, 1.) Polemic answer to Michel's treatise on the crossing of the optic nerves (in *A. f. O.*, vol xxiii, 2).

10. KELLERMANN. Anatomical examination of atrophic optic nerves, with a contribution to the question of the optic nerve crossing in the chiasm. (*Supplement to Z. M.*, vol xvii. Stuttgart, 1879.) There is an incomplete crossing in the chiasm ; by far the greater portion of the fibres are crossing ; the process is somewhat complicated, but finally the fibres of both nerves are intimately interwoven in the tracts. There are no lateral fascicles, *i e.*, bundles of fibres which at the lateral margin of the chiasm pass from the nerve to the tract of the corresponding side. There is no bundle of nerve fibres at all that passes through the whole chiasm without being interwoven with other fibres, neither the fibres which lie on the same side of the nerve or tract nor those which pass from one side to the other.

11. KRUKENBERG. Contributions to the anatomy and physiology of the retina. 1. Macula lutea and fovea centralis. 2. The retinal pigment of the birds of prey. 3. Occurrence of the visual ridge (Sehleiste). (*From the Physiol. Inst. of the University of Heidelberg*, vol. ii, 3.) The yellow coloring matter of the macula cannot, as yet, be regarded as a cadaverous decomposition.

12. LIEBERKÜHN. Contributions to the anatomy of the embryonic eye. (*Arch. f. Anat. u. Phys, Anat. Abth.*, heft No. 2.)

13. MAYS. On the brown pigment of the eye. (*Unters. aus d. Phys. Inst. d. Univers. Heidelberg*, Bd. ii, 3.)

14. MOHR. A contribution to the question of semidecussation in the chiasma nervorum opticorum. (*A. f. O.*, Bd. xxv, 1.) Mohr thinks that the semidecussation in the chiasm is absolutely proved. The fibres supplying the macula and its nearest surroundings come from the tract of the same side, while places which are less important for central vision are derived from the opposite tract.

15. RANVIER. De la régénération des nerfs de l'épithélium antérieur de la cornée et de la théorie du développement continué du système nerveux. (*Gaz. méd.*, No. 22.)

16. RANVIER. Transparence de la cornée. (*Soc. de Biol.*, 1879. Feb. 8.) The corneal corpuscles which are ordinarily not visible in the living tissue, become visible when exposed to steam.

17. SCHWALBE. On the morphological significance of the ganglion ciliare. (*Jenaische Zeitsch. f. Naturwissensch.*, Bd, xii, supplement, Jena, 1879.) The ciliary ganglion does not belong to the sympathetic system of ganglia, but to the oculomotorius, and is therefore similar to the spinal ganglia.

18. STILLING. Note on the importance of the occipital lobe of the brain for vision. (*C. f. A.*, Feb.)

19. WILBRAND and BINSWANGER. On ascending neuritis of the optic nerve in chronic hydrocephalus internus, with remarks on the distribution of the optic nerve fibres in the retina. (*Schles. Gesellsch für vaterl. Cultur*, 1879, Mai 24. *Breslauer ärztl. Zeitschr.*, No. 10.) The peripheric fibres of the optic nerve supply the periphery of the retina; those near the centre go to the macula. A similar opinion was expressed by Magnus: the optic nerve hæmorrhages. Leipsic, 1874, cap. ii, pag. 31.

PATHOLOGICAL ANATOMY.

20. ANGELUCCI. Marantic thrombosis of the central retinal vein. (*Z. M.*, April.) The walls of the veins were normal, and there was no trace of phlebitis; therefore, the thrombus could only have been formed by slow circulation of blood. Thé retinal hemorrhages mentioned by Michel as a constant symptom of thrombosis, could not be demonstrated.

21. BRESGEN. On the heredity of anomalies of the lens. (*C. f. A.*, April.) Congenital ectopia of both lenses in a mother and six children; the mother's sister and the grandmother (?) had the same defect.

22. BULL and PROUT. Sarcoma of the conjunctiva; amyloid infiltration and degeneration. (*New York Pathol. Soc.*, Feb. 20, 1879. *Med. Rec.*, vol. xv, 13. In extenso, These ARCHIVES, vol. viii, 1.)

23. CHAMBARD. Xanthelasma. (*Progrès méd.*, March 29, 1879.) There are two varieties, the flat and the nodular; the former is found mostly on the lids. Histologically it shows two processes, one of irritation, forming new connective tissue, and

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one of regressive metamorphosis, converting the cellular elements into fat.

24. FALKSON. A granulation sarcoma of the ocular conjunctiva in trachoma. (*Z. M. May*). The tumor, a simple round-cell sarcoma, was 10 *mm.* in diameter, and was situated in the region of the vertical meridian, about 1½–2 *mm.* from the cornea.

25. FALKSON. An intraocular tumor. (*Z. M.*, May, 1879.) Cicatrization with excessive proliferation of the scars after a destructive inflammation.

26. GALEZOWSKI. Sur les thromboses des vaisseaux rétiniens. *Gaz. méd. de Paris*, No. 17.) It is frequent and is developed under the influence of an endarteritis.

27. GOLDZIEHER. On a tumor originating from the internal limiting membrane of the retina. (*Z. M.*, Feb., 1879.) A connective tissue tumor starting from the Limitans interna with marked tendency to colloid formation.

28. GRUBER. On an osseous arch obstructing the entrance into the orbit below the upper margin, in a boy. (*Virchow's Arch. f. path. Anat.*, vol. lxxvii, 1.)

29. HAASE. Leptothrix buccalis in the lower lachrymal canal. (*A. f. A.*, Bd. viii, 2.)

30. v. HIPPEL. On amyloid degeneration of the lids. (Berlin, 1879.)

31. HIRSCHBERG. Contributions to the anatomy and pathology of the eye. (*A. O.*, vol. viii, 2, pag. 224.) 1. Right-sided hemiplegia with left-sided oculomotor paralysis and bilateral neuritis optica in a child. Tubercle in the left half of the pons. 2. Choked disk caused by a brain tumor. 3. Retinitis pigmentosa. 4. Sympathetic iridocyclitis. 5. Corneal ulcers consequent on blennorrhœa neonatorum.

32. HODGES. Glioma retinæ. (*Lancet*, Feb. 8, 1879.)

33. JANY. Case of formation of colloid excrescences in the lamina vitrea choroideæ near the optic disk. (*C. f. A.*, June, 1879.)

34. JONES, H. MACNAUGHTON. Symmetrical corectopia with dislocation of the lens. (*Dublin Journ. of Med. Sci.*, Feb., 1879.)

35. KIPP. A filaria in the eye of a horse. *Med. Record*, Feb., 1879.) In the anterior chamber he found a white cylindrical worm, 65 *mm.* long.

36. KUHNT. Two cases of disease of the optic nerve in brain

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disease and their pathological conditions. (*Versaml. d. Neurologen u. Irrenärzte in Heidelberg*, 17–18 Mai, 1879, *Memorabilien*, Bd. xxiv, 5.)

37. LANDSBERG. Sarcoma of the choroid in children. (*A. O.*, vol. viii, 3, pag. 345.)

38. LEBER. On the origin of amyloid degeneration, based on examinations of the conjunctiva, and on the origin of the amyloid bodies in the atrophic nerve-substance. (*A. f. O.*, vol. xxv, 1.) The amyloid degeneration of the conjunctiva is in its pathological changes as well as in its probable origin, similar to the sclerosing hyperplasia of connective tissue. The amyloid degeneration of the conjunctiva must clinically be regarded as a separate disease, but it is possible that it has certain relations to trachoma.

39. MANCHÉ. Fibroma mucoso dell' occhio. (*A. d'Ott.*, 1879, vol. i.)

40. MANDELSTAMM AND ROGOWITSCH. A case of amyloid degeneration of the bulbar and palpebral conjunctiva. (*A. f. O.*, vol. xxv, 1.)

41. NEISSER. On a form of micrococci peculiar to gonorrhœa. (*Centralbl. f. d. med. Wissensch.*, No. 28.) Certain characteristic micrococci seem to be of constant occurrence in all gonorrhoic affections of the urethra and conjunctiva.

42. NICATI. Cataracts et lésions dentaires des rachitiques. (*Revue mens. de méd. et chir.*, 1879, No. 1.)

43. NIEDEN. A case of atrophy of one optic nerve trunk with nearly normal diameter of both optic tracts. (*C. f. A.*, May, 1879.)

44. DE VINCENTIIS. Sull cancro delle palpebre. (*A. d'Ott.*, vol. viii, 1.) It has its origin in the rete Malpighi, in the modified sweat-glands of the lid-margin and the epithelium of the palpebral conjunctiva.

45. PANAS ET RÉMY. Anatomie pathologique de l' œil. (Paris, with 26 plates.)

46. POTJANS. On new formation of bone in the human eye. (*Inaug. Dissert., Bonn*, 1879. Conf. *A. O.*, vol. viii, 3, No. 263 of the bibliogr.) The formation of bone in the eye takes place only in those tissues which are able, by inflammatory processes, to furnish connective tissue.

47. REDARD. Tumeur périoculaire; lymph-adénôme. (*Progrès Méd.*, No. 3.)

48. RÉMY reports in (*R. d'O.*, March, 1879,) a sarcoma of the orbit in a child one year old.

49. RENDU. Gliosarcoma situé derrière la couche optique droite et empiétant sur le ventricule latéral. (*Paris Méd.*, Feb. 6, 1879.)

50. SAMELSOHN. Demonstration of an extirpated carcinoma of the orbit. (*Berliner Klin. Wochensch.*, 1879, No. 6.)

51. STEINHEIM. A wandering lens. (*C. f. A.*, Feb., 1879.)

52. TALKO. A case of microphthalmus with congenital cysts under the lower lid. (*Medycyny*, vol. vii, 27.)

53. VOGLER. Contributions from Dr. Hirschberg's eye-clinic. (*A. O.*, vol. viii, 3, pag. 374.) A case of retinal glioma with historical and critical remarks, stating the literature from 1870–1878.

54. WILLEMER. On tumors of the optic nerve proper, that is tumors which are developed within the outer sheath. (*A. f. O.*, vol. xxv, 1.) They occur frequently in children and are often caused by an injury. The principal symptom is exophthalmus. The mobility of the globe is often still relatively good. In the first stage neuroretinitis which passes over into atrophy of the nerve. Vision is always impaired very soon and very much; the prognosis is unfavorable. The tumors often contain mucous tissue; after these the fibrous or fibro-sarcomatous tumors are most frequent. The outer nerve-sheath is mostly normal; the tissue of the subvaginal space is more or less affected; the inner sheath participates more or less. The optic nerve itself either remains entirely normal, or is partly affected, or the whole optic nerve trunk becomes implicated.

55. WATSON. Melanotic sarcoma of the eyeball. (*The Lancet*, No. 15.)

II.—PHYSIOLOGY.

CORNEA, IRIS, CILIARY BODY.

56. RANVIER. Recherches expérimentales sur la signification physiologique du plexus nerveux terminal de la cornée. (*Gaz. méd.*, No. 24.)

57. BESSAU. The size of the pupil during sleep and in spinal diseases. (*Inaug. Dissert.*, Königsberg, 1879.)

58. BOCHEFONTAINE observed dilatation of the pupil on excitation of the dura mater of the dog in front, laterally from the falx. (*Arch. de Phys.*, Jan., Feb., 1879.)

59. FRANCK. Indépendence des changements du diamètre de la pupille et des variations de la circulation carotidienne. (*Acad. des sciences*, May 19, *Gaz. méd.*, No. 23.)

60. GRÜNHAGEN. On changes of the pupil in tetanizing the

sympathetic nerve and in spinal diseases. (*Verein für wissensch. Heilk.* at Königsberg, April 15, 1878, *Berliner Klin. Wochenschr.*, 1879, No. 15.)

61. HOLMGREN. On pupillastandet hos färgblinda. (*Ups. Läk. Förh.*, vol. xiv, pag. 73, and *A. f. O.*, vol. xxv, 1 and French translation.) The condition of the color-sense is without influence on the distance of the pupils.

62. PLOTKE. On the condition of the eyes during sleep. (*Inaug. Dissert.*, Breslau, 1879.)

63. VOGEL. The pupils during the chloroform narcosis. *Petersburger med. Wochenschr.*, No. 13.)

64. BOUCHARD. On the accommodation of the eye. (*Rec. de mém. de méd. milit.*, T. xxxiv.)

65. COULON. Etude sur le mécanisme de l'accommodation. (*Thèse de Paris*, 1879.)

66. CUSCO. Le dynamoptomètre ; instrument destiné à étudier la faculté d'accommodation. (*Présénté à l'académie de méd. de Paris*, March 11, 1879.)

67. DOMEC. Criticizes Rosset's theory of accommodation. (*Amer. Journ.*, Oct., 1878), in *R. d'O.*, Apr.

68. GRADLE. The action of the ciliary muscle in astigmatism. (*Amer. Journ. of Med. Scienc.*, Jan., 1879.)

69. HUNT. A criticism of Dr. de Rosset's theory of the action of the muscles of accommodation. (*New York Med. Journ.*, 1879, No. 1.)

70. VILMAIN. Essai sur la physiologie de l' accommodation. (*Thèse de Paris*, 1879.)

REFRACTING MEDIA. RETINA. OPTIC NERVE AND CENTRAL ORGAN. PHYSIOL. OPTICS AND COLOR-SENSE. OCULAR MUSCLES.

71. DEUTSCHMANN. On the regeneration of the aqueous humor after emptying of the anterior chamber. (*A. f. O.*, vol. xxv, 1.) If by puncture of the cornea the aqueous humor is removed from an eye soon after death, the anterior chamber is refilled with a clear fluid; immediately after death the anterior chamber is even refilled after the removal of this fluid. This regenerated aqueous humor contains much more albumen than the fluid which was emptied by the first puncture. The normal vitreous body contains a considerably higher percentage of albumen than the normal aqueous humor. The aqueous regenerated after death comes from the vitreous and enters the anterior chamber by filtration through the zonula because by the puncture the tension

of the anterior chamber has been diminished. The rapid refilling of the anterior chamber after puncture of the cornea during life is partly due to a filtration of fluid from the vitreous. If the tension in the vitreous chamber is pathologically increased, fluid will pass also during life from the vitreous through the zonula into the anterior chamber.

72. DOGIEL. Contributions to the knowledge of the reactions of albumen and on the conditions of the albumen of the refracting media. (*Arch. f. d. ges. Physiologie*, Heft 6 u. 7.) The quantity of albumen in the aqueous humor is said to be independent of the blood-pressure.

73. GRÉHANT. Note sur la régénération de l'humeur vitrée chez les animaux vivants, lapins, cochons d'Inde. (*Gaz. Méd.* 1879, No. 10, *Soc. de Biol.*, Feb. 15, 1879.) Young rabbits showed four weeks after removal of the lens and of the greater portion of the vitreous not only restoration of the vitreous but also of the lens with the capsule. (?)

74. PHILIPPEAUX. Régénération de l'humeur vitrée. (*Progres Méd.*, 1879, No. 8, *Soc. de Biol.*, Feb. 15, 1879.)

75. SCHÖLER. On the excretion of fluid from the eye. (*Berliner phys. Gesellschaft*, June 20, 1879, *Verhandl. d. phys. Ges.*, Jahrg, 1878–79, No. 17.) Burning of the corneal margin causes glaucoma. After puncture of the cornea or sclerotic, the symptoms do not occur in spite of the burning. Also the burning of a zone of the cornea and sclerotic to the extent of 2–3 *mm.* produces glaucomatous symptoms. The retardation of the escaping fluid caused by closure of the limbus, is in the rabbit about ⅓ to ½ of the whole quantity of excreted fluid, in the human eye it is about ⅔. Ligation or combustion of the vortex veins causes only inconsiderable increase of tension. Ligation of the optic nerve causes no disturbance in the currents of the fluids of the globe; there are therefore probably no posterior lymph-spaces around the optic nerve.

76. SORET. Sur la transparence des milieux de l'œil pour les rayons ultraviolets. (*Comtes-rendus hebd. d. séances de l'acad. d. sci.* 1879, No. 20.) The aqueous and vitreous humor are very similar in regard to their transparency for ultra-violet rays, cornea and lens absorb more strongly. All the media combined probably let no rays pass which lie beyond the line U of the solar spectrum.

77. BEAUREGARD. Contribution à l'étude du rouge rétinen. (*Journ. de l'anat et de la phys.*, 1879, No. 2.)

78. CARRÉ. De la vision des hystériques. (*Gaz. d'Ophth.*, No. 1.)

79. GALEZOWSKI. Sur la perception du rouge de la rétine par le malade lui même. (*Gaz méd. de Paris*, No. 28.)

80. GIRAUD-TEULON. Acuité visuelle, de ses éléments et de leur mesure. (*A. d'O.*, May and June, 1879.)

81. MAUTHNER. Ophthalmological lectures for students and physicians. 3. Heft. The functional examination of the eye (Wiesbaden, 1878.) Central acuteness of sight; sense of light; visual field; blind spot.

82. MAUTHNER. On incongruence of the retina. (*Wiener med. Wochensch.*, 1879, Nos. 14 and 15.)

83. NETTLESHIP reports observations on the visual purple in man. (*Journ. of Physiol.*, 1879, No. 1.)

84. RICHET ET BREGUET. Influence de la durée et de l'intensité sur la perception lumineuse. (*Gaz. Hebd.*, No. 7.)

85. RICHET ET BREGUET. Perception lumineuse. (*Arch. gener.*, April, 1879.)

86. SCHWEIGGER. Note on the median limit of the visual field. (*A. f. O.*, vol. xxv, 1.) The peripheral portion of the retina on the temporal side is sensitive and not, as was hitherto supposed, insensible to light, but the acuteness of sight is no more than a simple perception of light.

87. CURSCHMANN. On the central centres of the sense of vision. (*Berliner Gesell. f. Psych.*, June 9, 1879, *C. f. A.*, June.) In a case of left-sided hemianopsia the post-mortem examination showed a large area of softening in the right occipital lobe extending to the surface and situated especially on its upper side and at the apex.

88. MOELI. Experiments on the cortex cerebri of the rabbit. (*Virchow's Arch.*, vol. lxxvi, 3.) Destruction of the posterior half of the cortex cerebri causes disturbances of vision in the opposite eye; when the destruction was not too considerable the disturbance of sight soon disappeared.

89. ALBINI. On typographical visual tests. (*Gior. internazionale delle Sc. med.*, vol i, 1.)

90. BAROFFIO speaks (*in Giorn. di med. militare*, 1879, No. 1) of the means by which defects of vision can be demonstrated.

91. CHARPENTIER. Sur la quantité de lumière perdue pour la mise en activité de l'appareil visuel et ses variations dans différentes conditions. (*Comptes-rendus de l'Acad. des sciences*, Jan. 27, 1879.)

92. CLITKEN. A new variety of ocular spectrum. (*Journ. of Anat. and Phys.*, T. xiii, 3.)

93. CORNU. Sur l'absorption par l'atmosphère des radiations ultraviolettes. (*Compets-rendus hebd. des séances de l'académie des sciences*, 1879, 25.)

94. DONDERS. Des systèmes dichromatiques. (*A. d'O.*, Jan. and Feb., 1879.

95. FICK. On the periscopy of the eye. (*Arch. of Phys.*, vol., xix.) The situation and curvature of the lens are very favorably arranged for periscopic vision.

96. FICK. On the relation between myopia and divergent squint. (*Breslauer ärztl. Zeitsch.*, vol. 1, 5.) A polemic answer to this article is No. 97 of this bibliogr.

97. GRAEFE. Myopia and divergence. (*Breslauer ärztl Zeitschr.*, vol., i, 7.) The small demand on accommodation in myopia is the principal cause of the latent divergence, but since the relations between convergence and accommodation are totally different in emmetropia and myopia we cannot at once apply to myopia the rules of association between convergence and accommodation which are found in emmetropia.

98. GRASSMANN. The refraction-ophthalmoscope. (*Z. M.*, March.)

99. GUEBHARD. Exposé élémentaire des découvertes de *Gauss* et de *Listing* sur les points cardinaux des systèmes dioptriques centrés. (*A. d'O.*, May, June, 1879.)

100. VAN HAAFTEN. Het bepalen van Astigmatisme. (*Dissert. Utrecht*, 1879.)

101. VON HASNER. The average eye in its physiological and pathological relations. (Prague, 1879.)

102. HEUSE. Once more Zöllner's pattern. (*A. f. O.*, vol. xxv. 1.)

103. HIRSCHBERG. Miscellaneous contributions. A Stationary ophthalmoscope. (*C. f. A.*, June.)

104. JAESCHE. Stereoscopic vision. (Stuttgart, 1879, Ferd. Enke.)

105. JAVAL. Sur l'astigmatisme. (*Soc. de Biol.*, Feb. 22, 1879.)

106. JAVAL. Hygiène de la lecture. (*Annal. d'hyg. publ.*, 1879, pag. 60; *Gaz méd de Paris*, Jan. 4, 1879,)

107. JAVAL. Essai sur la physiologie de la lecture. (Continued, chapter 5.) Influence de l'éclairage sur l'acuité visuelle. (*A. d'O.*, Jan. to June, 1879.)

108. KLEINER. Observations in physiological optics. (*A. f. Phys.*, vol. xix.) 1. On Talbot's law. 2. On the psycho-physical,

resp. Weber's law. 3. On the contention of the visual fields. 4. On illusive motions.

109. LOISEAU. Note sur un nouveau modèle de l'optomètre métrique et du phacomètre portatif. (*A. d'O.*, Jan., Feb., 1879.) Report of Warlomont, *ibidem.*

110. MATTHIESEN. The differential equations of the dioptrics of the lamellated crystalline lens. (*Arch. f. d. ges. Phys.*, vol. xix, 10 and 11.)

111. MAGNUS. Contributions to the knowledge of physiological optics and ophthalmo-therapeutics of the ancients. (*Z. M.*, June 1.) Accommodation. The ancients have partly observed the phenomena of accommodation, but did not understand the accommodative process itself.

112. PROMPT. Note sur une illusion optique. (*Gaz. med.*, No. 6.)

113. PROMPT. Procédé optométrique. (*Soc. de Biol.*, April 26, 1879.)

114. VON REUSS. Some observations on functional and ophthalmoscopical determination of refraction. (*Arch. f. O.*, vol. xxv, 1.) The binocular examination of vision gives often a result which is nearer to the real condition of refraction than the separate examination of each eye. The myopic patients show in binocular examination a lower degree of myopia than the less myopic eye when examined alone; hyperopic persons show in binocular examination a higher degree of hyperopia than the more strongly hyperopic eye in the separate examination.

115. SAMELSON. Perception of the fundus in aphakia. (*C. f. A.*, March, 1879.)

116. SIEBER. Researches on the abnormal dispersion of light. (*Inaug. Dissert., Bonn*, 1879.)

117. SNELLEN. Lentille de Stokes modifiée. (*A. d'O.*, 81, pag. 106.)

118. SOUS. Traité d'optique considérée dans ses rapports avec l'examen de l'oeil. (Paris, 1879, *Doin*, 362 pag. with 87 illustr.)

119. SPODE. On optical reflex-inhibition. (*Arch. f. Anat. und Phys., Physiol. Abth.*, Heft 1 u. 2.)

120. STILLING. Note on examination of the eye in the erect image. (*Z. M.*, Feb., 1879.)

121. THOMSON. A practical and rapid method, with an instrument, for the diagnosis of the refraction. (*Trans. of the Amer. Ophth. Soc.*)

122. USKOFF. Influence of the colored light on the protoplasm. (*Centralbl. f. d. med. Wissensch.*, No. 25.)

123. VALENTIN. A contribution to the knowledge of the refraction of animal tissues. (*Arch. f. Phys.*, 1879, Heft 2 u. 3.)

124. VON WECKER. Ophthalmoscope a double disc. (*A. d'O.*, March, April, 1879; *Z. M.*, March.)

125. BATUT. De la chromatopseudopsie. (*Thèse de Paris.*)

126. CHARPENTIER. Sur la sensibilité de l'oeil à l'action de la lumière colorée, plus ou moins additionnée de lumière blanche et sur la photométrie des couleurs. (*Acad. des scienc.*, Feb. 10, 1879; *Gaz. méd.*, Fo. 9.)

127. CHEVREUL. La vision des couleurs. (*Acad. des scienc.*, May 12; *Revue scientif.*, No. 47.)

128. COHN. On congenital and acquired blue-yellow blindness. (*Schles. Gesellsch.*, Feb. 28; *Breslauer ärztl. Zeitschr.*, No. 6.)

129. COHN. Studies on congenital color-blindness. (*Breslau*, 1879, *Morgenstern*, 281 pag.) He opposes the division into: red-, green-, blue-blindness. He changes Holmgren's method in such a manner that he leaves out the test with light-green wool, and examines with light-red wool.

130. COHN. Acuteness of sight and color-sense in electric light. (*C. f. A.*, April.) The intensity of the color-perception is increased.

131. COURSSERANT. Sur l'emploi méthodique des verres de couleurs dans l'achromatopsie. (*Acad. des scienc.*, April 21, 1879; *Gaz. med.*, No. 19.) The color-blind person should wear glasses of the complementary color.

132. DAAE. On color-blindness. (*Deutsche med. Wochenschr.*, 1879, No. 1.)

133. DAAE. Color-blindnes and how to recognize it. Plate and text; translation from the Norwegian by Dr. Sänger. (Berlin, 1879, Dörffel and Hirschwald.)

134. FAVRE. Le traitement de daltonisme congénital par l'exercice, chez l'enfant et chez l'adulte. (*Gaz. hebd.*, 1879, No. 6 and 7.)

135. DE FONTENAY. On color-blindness in Denmark. (*C. f. A.*, May.) In his method of examination and classification he follows strictly Holmgren's views. Among 5,287 men, there were 189 completely or incompletely color-blind, *i. e.*, 3.57 per cent. Among 3,663 women, there were 16 color-blind, =0.43 per cent. Among men of the lower classes the per cent. was 4.04, among those of the better classes only 3.34; the women of the lower classes showed 0.65 per cent., those of the better classes none at all.

136. GORI. On the treatment of defective perception of colors. (*Nederl. Tijdschr. voor Genesk.*, vol. xiv, 2.)

137. HALL. On the perception of color. (*Proceedings of the Amer. acad. of arts and sciences*, vol. iii.)

138. HIRSCHBERG. On a modification of the spectroscope for the examination of color-blindness. (*Arch. f. Anat. u. Phys., Physiol. Abth.*, Heft 1 u. 2.)

139. HIRSCHBERG. The double spectroscope for the analysis of color-blindness. (*C. f. A.*, Feb.)

140. HOLMGREN. Bidrag till Färgblindhetens statistik. (*Upsala Läk. Förh.*, vol. xiv, 8 and 9.)

141. HOSCH. Statistical contributions to congenital color-blindness. (*Corresp. Blatt. f. Schweiz. Aerzte.*, Jahrg. ix.) Among 1,595 school-boys 63 were color-blind, *i. e.*, 3.95 per cent.; among 680 school-girls only 1, *i. e.*, 0.14 per cent.

142. JEFFRIES. Color-blindness among school-children. (*Boston Evening Transcript*, April 9, 1879.) He urges the methodical education of the color-sense in schools.

143. JEFFRIES. Color-blindness; its dangers and its detection. (Boston, 1879, 312 pages.) In the method of examination and classification he entirely follows Holmgren, to whom the book is also dedicated. Among 10,387 men, there were 431 color-blind, = 4.149 per cent.; among 7,942 women, only 4, = 0.52 per cent.

144. JUST. Contributions to the statistics of myopia and of the color-sense. (*A. f. Aug.*, vol. viii, 2.) Among 834 school-boys, 22 were color-blind, = 2.6 per cent.

145. KALISCHER. Color-blindness. A popular representation of its importance, its theories, its occurrence, and the methods of examination. (Berlin, 1879. Also published in *Die Natur*, 1879, No. 7–14.) Kalischer follows Holmgren's classification.

146. KEYSER. Report on the examination of railroad employés for color-blindness, (*Med. Record*, No. 448, New York, June 7th.)

147. LEDERER. On the mechanism of color perception. (*Kosmos*, March, 1879.) Lederer explains the mechanism of color perception in such a manner that the perception of the different colors depends upon the vibrations of fibres of different calibre, the cones vibrating under other conditions than the rods. From this mechanical view he explains red-blindness by insufficient development of the retinal cones, having either smaller dimensions or being of abnormal elasticity. Green-blindness might be produced by changes of elasticity of the cones, and in that case we would

have to suppose that, for the more rapid vibrations the cones are too rigid or slugglish. A similar supposition we would have to adopt in regard to the rods in violet-blindness.

148. MAGNUS. Examination for color-blindness of 5489 school-boys and school-girls of Breslau. (*Breslauer ärzsl. Zeitschr.*, No. 2.) The physiological color-blindness. (*Das Ausland*, 1879, No. 3, *und Allgem. Zeit.*, May 26, 1879.)

149. MAGNUS. The methodical education of the color-sense, with plate of colors and seventy-two colored papers. (*Breslau*, 1879, *F. U. Kern's Verlag.*) The methodical education of the color sense does not intend either to cure color-blindness or to develop the power of perceiving colors in the sense of evolution, but to bring the color-sense which from insufficient use had become limited, or which had not been sufficiently developed, to as perfect a function as can be obtained according to its organization.

150. MEYHÖFER found in Görlitz among 292 school-girls, two color-blind sisters, Jewesses. (*Schles. Zeitung*, No. 187, 1879.)

151. MOELLER. Étude critique des méthodes d'exploration pour les recherches des Daltoniens dans le personel des chemins de fer. (*Bull. de l'Acad. royale de méd. de Belg.*, vol. xiii, 2,) and ibidem : Rapport sur la réforme des employés des chemins de fer affectés de Daltonisme en Suède, Norwège et Danemark.

152. MOELLER. Du Daltonisme, au point de vue théorique pratique ; (Bruxelles, 1879.) Based on Young-Helmholtz's et theory ; the best method of examination is that of *Holmgren.*

153. PICARD. La cécité des couleurs. (*Gaz. méd.*, No. 11.)

154. v. REUSS. On color-blindness. (*Wiener Klinik*, vol. v, 3.) After the statistics of Dr. Gintl, thus far, 41,444 employés of Austrian and German railroads have been examined ; among them were color-blind 319=0.769 per cent. (!) Reuss found among 593 railroad employés entirely color-blind 10=1.68 per cent., and incompletely color-blind 9=1.51 per cent., together =3.2 per cent.

155. SCHASSLER. Harmonious combination of colors. (*Westermann's Monatshefte*, 1879, No. 1.)

156. STATISTISCHES BUREAU. (Journal of the Prussian board of statistics and *Allgem. med. Central-Zeitung*, vol. xlviii, 6.) According to the statistics of the department for railways the results of the examination for color-blindness were as follows. Color-blind were: officers of the station, 0.44 per cent.; formers of trains, 0.90 per cent.; conductors, 0.45 per cent.; engineers, 0.85 per

cent.; foremen, 0.30 per cent.; flagmen, 0.90 per cent.; switchmen, 0.62 per cent.

157. STILLING. The present aspect of the color-question, (*A. O.*, vol. viii, 2, page 164) against *Holmgren's* tests. It is stated that with Holmgren's test 1, the diagnosis of reduced color-sense is impossible; 2, persons who are really color-blind can remain undetected, when they prepare themselves for the examination; 3, simulation can not with certainty be proved.

158. SULLY. Harmony of colors. (*Mind.* No. 14, April, 1879.

159. TALKO. On the examination of railroad employés for color-blindness. (*Sowrennaja Medicina*, 1879, No. 11 and 12.)

160. WOLFE. On color-sight and color-blindness. (London, 1879, J. and A. Churchill, also in *Med. Times*, 1879, No. 1501–3.)

161. GOWERS. The movements of the eyelids. (*Lancet*, No. 24. *Plotke* conf. No. 68 of this bibliog.)

162. RÆHLMANN. On the influence of consciousness upon the coördination of the movements of the eye and upon squint. (*Z. M. Fan.*)

163. WITKOWSKI. On some phenomena of ocular movements. (*Arch. f. Psych.*, vol. ix, 1 and 2.)

III.—THERAPEUTICS.

MEDICAMENTAL THERAPEUTICS.

Atropine, Duboisine, Eserine.

164. BOUCHERON. Pathogénie et traitement du strabisme convergent intermittent, sans opération par les mydriatiques ou les myosiques chez les enfants. (*Union méd.*, March 29, 1879, and *Z. M.*) The accommodation should be paralysed by mydriatics in order to correct convergence which accompanies the accommodation.

165. BULL. The use of eserine and pilocarpine in ophthalmic therapeutics. (*New York Med. Jour.*, April, 1879.)

166. CLARKE treats lesions of the ciliary region with eserine. (*St. Barthol.-Hosp. Rep.*, vol. xiv.)

167. DEHENNE. Sur l'emploi de l'eserine en ophthalmologie. (*Moniteur de la policlinique*, April 13, 1879.)

168. FAUQUÉ. De la duboisine. (*Thèse de Paris*, 1879, and *R. d'O.*, April and May.) Duboisine is preferable, when paralysis of accommodation is intended, and also in those cases in which atropine causes irritation.

169. GALEZOWSKI. De l'action mydriatique de la duboisine et de al'tropine. (*Gaz des Hôp.*, No. 6.)

170. GALEZOWSKI. Eserine and Pilocarpine. (*R. d'O.*, March to May.) Eserine is employed with advantage in conjunctival inflammation and in corneal abscess. In glaucoma it acts favorably in the beginning, but sometimes it aggravates it. In alcohol-amblyopia and in endemic hemeralopia the duration of the disease can be shortened by eserine. In certain forms of iritis it is well to alternate eserine and atropine.

171. HOLMES. Some notes on atropia, dubosia, eserine, pilocarpine and muscarine as used in ophthalmic practice. (*Med. Rec.*, No. 442, New York, April 26, 1879.

172. JUST. Communications from the ophthalmic institute at Zittau. (*C. f. A. May.*) Eserinum salicylicum from *Merck* of Darmstadt, does not seem to be decomposed as readily as the sulphate. Also Atrop. salicyl. was kept for weeks without the well-known deposits of the Atrop. sulph.

173. LUTAUD reports cases of poisoning by atropine collyria. (*Union méd.*, April, 1879.)

174. NORRIS. Duboisia as a mydriatic with remarks on its physiological and toxic effects. (*Amer. Jour. of Med.*, Apr., 1879.)

175. SEELY. Remarks on duboisia, the new mydriatic. Cincinnati. (*Lancet and Clinic*, Jan., 1879.)

176. SIDNEY RINGER. Pituri (from Duboisia Hopwodii) produces in small doses internally contraction, in large doses dilatation of the pupil. On local application the pupil is first contracted and then dilated. (*Lancet*, March, 1879.)

177. WATSON. A note on the use of eserine in glaucoma. (*Med. Times and Gaz.*, No 1511.) Good result in a case of simple glaucoma; removal of pain in acute glaucoma.

178. DE WECKER. Valeur sémiologique de la mydriase et du myosis. (*Gaz. des Hôp.*, February 13, 1879.)

179. WELLS. Spasm of the ciliary muscle treated by Duboisine. (*The Lancet*, No. 7.)

JABORANDI. PILOCARPINE.* STRYCHNINE.

180. BLOCH. Du Jaborandi; son emploi thérapeutique, en particulier dans le mal de Bright. (*Thèse de Paris*, 1879.)

181. LANDESBERG. On the therapeutic use of Jaborandi and Muriate of Pilocarpine in eye-diseases. (*Philadelphia Med. Times*, vol. ix, No. 298.)

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* *On Pilocarpine conf.* 165, 170, 171, *of this bibliogr.*

182. MORANO. Dell' uso della stricnina in talune malattie del fondo dell' occhio. (*G. O.*. 1879, 1 and 2.)

183. PITOIS. Jaborandi et Pilocarpine. (*Thèse de Paris*, 1879.)

DIVERSA.

184. BRIÈRE. Des collyres à la teinture d'iode. (*Journ. de Méd. de Bordeaux*, May 24, 1879.)

185. BRIÈRE. Communications ophthalmologiques. (*A. d'O.*, January, February.) The following chapters are of special interest as to therapeutics: De l'abus des cautérisations et de la valeur des scarifications dans les conjonctivites purulentes. Cinq cas de pannus granuleux généralisés, guéris par l'ophthalmie purulente contractée accidentellement. Dix-neuf pannus rebelles traités par la syndectomie. Nevrite optique double syphilitique. Cécité complète pendant trois jours, guérison rapide.

186. BRIÈRE calls attention to the danger of collyria containing lead. (*Gaz. des Hôp.*, 23.)

187. COURSSERANT. Sur les irrigations oculaires et l'emploi méthodique des collyres. (*Soc. de chir.* Jan. 29, 1879, *Gaz. méd.* No. 6.)

188. JELLINEK. On the diagnosis and treatment of conjunctival catarrh. (*Mitth. des Verins der Aerzte in Niederösterreich*, vol. v, 2.)

189. LEIBLINGER. The surest cure of trachomatous pannus by the spray of sulphate of copper. (*Wiener med. Worchensch.*, No. 4.) A solution of 1.0 : 200.0 which later is increased to 1.0 : 100.0 should be directed against the cornea for one minute; after a pause of two minutes the spray is used again; this application is made three times in each sitting. Already after 10–12 sittings the cornea is said to be considerably clearer.

190. LOPEZ-OCAÑA. Les sales metálicos en oftalmologia. (*Gazeta médica de Cataluña*, March 25, 1879.)

191. MAGNUS AND FRAENKEL. On the use of pure alum in substance in conjunctival diseases. (*Breslauer ärztl., Zeitsch.*, No. 7 and 8.)

192. MANOUVRIEZ calls attention to the dangers of collyria containing lead on account of the local saturnismus by direct absorption. (*Gaz. des Hôp.*, 32.)

193. MEYERHAUSEN Improvement of central vision and almost complete restoration of the normal visual field in Retinitis pigmentosa. (*Z. M.*, April.) Perspiration induced by subcutan-

eous injections of Pilocarpine (0.01), and since this remedy caused too much vomiting, by diaphoretic tea.

194. PANAS. Cases of trachomatous pannus which resisted peritomy and all medical treatment, but were cured by blennorrhoic inoculation. (*Gaz. des Hôp.*, 134.)

195. POPE. Opium as a tonic and alterative; with remarks upon the hypodermic use of the sulphate of morphia and its use in debility and amaurosis. (*New Orleans Med. and Surg. Journ.*, Feb., 1879.)

196. WEBSTER. A case of spontaneous cure of subretinal effusion. (*Transactions of the Amer. Ophthalm. Soc.*)

197. WEBSTER. The treatment of inflammations of the conjunctiva by means of medicated spray. (*The phys. and pharm. month. Journ.*, vol. xii, 4.)

198. VON WECKER. Thérapeutique oculaire. (*Leçons rec. par le Dr. Masselon*, Paris, 1879, Dion.)

PHYSICAL THERAPEUTICS.

Electrotherapeutics and Actual Cautery.

199. BROSSARD. Abcès interstitiels multiples de la cornée; punction au fer rouge. (*Lyon méd.*, 1879, No. 6.)

200. DUJARDIN-BEAUMETZ. Cécité hystérique; amélioration par la métallothérapie, guérison par l'électricité statique. (*Soc. méd. des hôp. de Paris*, May 9, 1879.)

201. GILLET DE GRANDMONT has used the bipolar electrode for the local electrization of the ocular muscles and has cured paralysis and insufficiency. (*A d'O.*, Jan., Febr.. 1879.)

202. GATTI. On Magni's modified cautery for the operation of trichiasis. (*Rev. clin.*. 2. *S.*, vol. ix, 1.)

203. KORN. The galvano-cautery in ophthalmic surgery. (*Schles. Presse*, No. 488. *Breslauer Zeitung*, No. 326.)

204. LEGRAUX. Du traitement de la phlyctène conjunctivale et kératique par la cautérisation galvanique. (*Presented to the Soc. de Méd. prat. de Paris*, Feb. 20. *France Méd.*, No. 46.)

METALLOSCOPY.

205. CHARCÔT, LUYS ET DUMONTEPELLIER. Étude expérimentale sur la métalloscopie et la métallothérapie de Burcq. (*Paris.*)

206. MÜLLER. On metalloscopy and the action of the

magnet in hysterical paralysis. (*Berliner klin. Wochensch.*, No. 28.) By the use of metalloscopy the right eye of an hysterical patient which had been color-blind, except for red, began to recognize colors again, perceiving yellow first, and violet latest. But the left, normal eye, became color-blind while the right eye improved; the perception of violet disappeared earlier than that of green, and this again before that of blue and yellow.

207. WEBER, of Darmstadt, observed in a case of left-sided hysterical hemianaesthesia with disturbances of the color-sense, a return of the normal perception of colors by the use of the magnet. (*Centrabl. f. Nerven.*, No. 7.)

DIVERSA.

208. HOCK. Air-douche in blennorrhœa of the lachrymal sac. (*C. f. A.*, March, 1879.)

209. MARTIN. De l'emploi de la lumière blene conjuguée avec la lumière blanche, dans le traitement des maladies chroniques de la rétine et du nerf optique. Des bains de lumière et des verres bichromiques. (*Gaz. des Hôp.*, Feb. 6.)

210. NIEDEN. On the treatment of blennorrhœa of the lachrymal sac. (*C. f. A.*, May, 1879.) He recommends the air-douche by means of Anel's syringe, modified by himself, or with a rubber ballon.

IRIDECTOMY* AND SCLEROTOMY.

211. FIENZAL advises against iridectomy in hæmorrhagic glaucoma. (*Gaz des Hôp.*, 1879, No. 4.)

212. JANY. Contribution to the therapeutics of glaucoma. (*Deutsche Med. Wochenschr.*, No. 20 and 21.) Good result from sclerotomy in two cases.

213. KUHNT. A modification of iridectomy for optical purposes. (*C. f. A.*, May.)

214. WARLOMONT. Lances graduées pour l'iridectomie. (*A. d'O.*, March, April, 1879.)

215. WATSON SPENCER. The treatment of glaucoma. (*Med. Times and Gaz.*, 1879, No. 1492.) He generally prefers iridectomy to sclerotomy, but in certain cases thinks the latter alone indicated.

CATARACT.

216. AGNEW. Cataract extraction. (*The Med. Rec.*, vol. xv, 19, May 10.)

* On Iridectomy conf. also 229 of this bibliogr.

217. COLSMANN. On the removal of a large continuous piece from the anterior lens-capsule in cataract operation combined with iridectomy. (June, 1879.)

218. GALEZOWSKI. On secondary cataract and its operation. (*R. d'O.*, June.)

219. GATTI. Knife for the corneal section. (*Rév. clin.*, 2, S., vol. ix, 1.)

220. HIGGENS. Remarks on 150 operations of extraction of cataract. (*Lancet*, No. 11 and 12.) The lower flap section was made in 104, the linear section in 24, the oblique corneal section in 21 cases; in 76.2 per cent. the result was satisfactory. He recommends preliminary iridectomy or extraction with iridectomy.

221. MONOYER reports on congenital cataract, treated repeatedly with division. (*Gaz. des Hôp.*, 1879.)

222. REULING. The extraction of cataract within the lenticular capsule. (*New York Med. Journ.*, 1879, No. 1.)

223. ROUX. Des principaux procédés d'extraction de la cataracte et en particulier de l'extraction linéaire, sans l'iridectomie. (*Thèse de Paris*, 1879.)

224. SILVE. Du prolapsus du corps vitré dans l'opération de la cataracte. (*Thèse de Paris*, 1879.)

225. TAMAMCHEF. On extraction and absorption of cataract. (*Gaz. des Hôp.*, 3–6.)

226. VERNON. On the symptoms and treatment of beginning cataract. (*St. Barthol.-Hos. Rep.*, vol. xiv.)

227. DE WECKER. De l'extraction à lambeau périphérique combinée. (*A. d'O.*, March, April, 1879, and *Z. M.*, May.) These papers are taken from Wecker's book: Chirurgie oculaire (conf. 254 of this bibliogr.)

DETACHMENT OF THE RETINA.

228. COHN. The final results of the drainage-treatment in detachment of the retina. (*C. f. A.*, May.)

229. COURIS. Étude sur le décollement de la rétine et son traitement par l'iridectomie. (*Thèse de Paris*, 1879.)

230. HEUSE. Detachment of the retina. (*C. f. A.*, June.) He recommends, after the retina becomes reapplied, compressive bandage during night for life.

231. HIGGENS. The treatment of displaced retina by operation. (*Med. Times and Gaz.*, No. 1505.) Five cases were treated

by drainage with bad results; in all of them inflammatory processes occurred.

232. HIRSCHBERG. Notes on the operative treatment of detachment of the retina. (*A. O.*, vol. viii, pag. 11.) A. Gräfe's scleral puncture is without danger and can be undertaken in most cases. Generally we shall obtain a cure at first; but relapses will occur, and perhaps, even be the rule. (Ten cases, in one a good result, observed for eleven months.)

OPERATIONS ON THE LIDS AND CONJUNCTIVA.

233. BACHON. On the treatment of trichiasis. (*Rec. de mém. de méd.*, T. XXXV, 3.)

234. DEHENNE. Entropion et trichiasis, canthoplastie et sutures de Gaillard. Guérison. (*Moniteur de la policlin.*, May 11.)

235. ESTLANDER. A case of blepharoplasty. (*Finska läkaresällskhandl.*, vol. XX, 4.)

236. FANO. Nota sulla cura del simblefaro ottenuta cor un autoplastica conjunctivale. (*A. d'Ott.*, 1879, Fasc. 1.)

237. GALEZOWSKI stitches the detached head of the pterygium into the wound, in order to prevent relapses. (*R. d'O.*, March.)

238. GRADENIGO reports the successful transplantation of a flap of skin into the conjunctival sac. (*Bulletino di oculistica*, March, 1879.)

239. MAGNI. Blepharoplasty with transplantation of cornea. (*Rev. clin.*, 2, S., vol. ix, 2.)

240. NICATI. Transplantation of the ciliary margin and marginoplasty. (*Marseilles méd.*, Feb., 1879.)

241. WARLOMONT. De l'opération du trichiasis. Aiguille à suture à canule pour les operations, qui se pratiquent sur les paupières et la conjunctive. (*A. d'O.*, March, April.) 1–2 *mm.* above the ciliary margin, the skin of the upper lid is divided and the upper flap detached from the underlying tissues; then 4–5 vertical catgut sutures are passed through the ciliary margin of the skin and the orbicularis to the level of the tarsus and up to its upper margin and tied; the flap of the skin is then allowed to fall back.

242. VON WECKER. A trichiasis-operation which is easy to perform and very effectual. (*Z. M.*, April.)

243. ZEHENDER. On ectropium-operations by transplantation of large pieces of skin. (*Z. M.*, June.) Large pieces of skin, freed from fat, became attached, but the effect of the operation

was destroyed again by the subsequent shrinking of the transplanted skin.

DIVERSA.

244. AGNEW. A curved knife for certain forms of stricture of the inferior lachrymal canaliculus. (*Transact. of the Am. Ophthalm. Soc.*)

245. EMRYS-JONES. Section of the cornea in hypopyon-keratitis. (*Lancet*, 1879, 3.) He recommends a large section through the cornea with evacuation of the pus: Good result in 35 cases.

246. FRIBURG. Sutures des plaies de la sclérotique. (*Thèse de Paris*, 1879.)

247. GALEZOWSKI unites scleral wounds with gold-wire or catgut. (*R. d'O.*, March, 1879.)

248. KNAPP. The removal of foreign bodies from the interior of the eye. (*A. O.*, vol. vii, pag. 311.)

249. MANDELSTAMM. On scraping of the lachrymal sac with a spoon. (*C. f. A.*, June.)

250. MANZ. Extirpation of an osteoma from the orbit. (*A. O.*, vol. viii, 3, pag. 320.)

251. MAUTHNER. Lectures on Ophthalmology. Sympathetic ophthalmia, second part. Pathogenesis and therapeutics. (*Wiesbaden*, 1879.) Mauthner does not seem to be in favor of the neurotomia optico-ciliaris. On enucleation he says: "The enucleation may be performed as a preventive measure; it must be done, when there is any irritation; it must not be done in serous and plastic iritis; it can be done in plastic iridocyclitis, if the first affected eye is totally blind and after the inflammatory stage is over."

252. NIEDEN. Three cases of retrobulbar, pulsating, vascular tumor, cured by ligation of the carotid. (*A. O.*, vol. viii, 3, pag. 328.)

253. SNELL. On keratotomy in hypopyon. (*Brit. Med. Jour.*, 2.)

254. DE WECKER. Chirurgie oculaire. (Paris, 1879, *Octave Doin.*)

255. ZEHENDER. Text-book of Ophthalmology. (*Stuttgart, Enke*, 1879.)

ABSTRACT OF AMERICAN OPHTHALMOLOGICAL LITERATURE.

FOR THE LATTER HALF OF 1879.

By SWAN M. BURNETT, Washington.

1. Notes on intra-ocular lesions produced by sunstroke. By F. C. Hotz. *Amer. Journ. Med. Science*, July.

Dr. H. reports six cases of optic neuritis which, in his opinion were clearly attributable to sunstroke. In all a good recovery was made. He thinks that the congestion of blood in the head leads to congestion of the sinuses, and it may be to an effusion, which is, according to Schwalbe, transferred to the inter-vaginal space, producing the symptoms of choked disk.

Two cases of *choroidit. exsudat.* accompanied by detachment of the retina, are also referred to the same cause. In these cases he thinks the inflammation propagated from the meninges to the uveal tract along the inter-vaginal space.

2. Intra-orbital sarcoma forcing the eye downward and forward; removal of tumor and replacement of the eye. By J. H. Packard. *Amer. Journ. Med. Sc.*, July.

A woman 67 years of age, during a confinement in 1847, felt something "give way" in her right eye. A prominence of that eye has been noticed ever since, and it has been progressively increasing. A cut is given showing the cornea protruding some distance beyond the nose. Dr. P. made an incision just below the brow and enucleated a tumor the size of a hen's egg, with the knife, handle and finger. It was slightly attached at the back portion of the orbit. The eye returned to about its normal position and there is binocular vision.

3. A case in which the sight of one eye was so imperfect as to

be practically useless without the consciousness of the patient. By D. WEBSTER. *Hosp. Gazette*, July 5th.

4. Emphysema of upper lid produced by blowing the nose after injury. By A. D. WILLIAMS. *St. Louis Med. and S. Journ.*, July.

A woman fell and struck her forehead, but there was no break in the skin. On blowing her nose, the eyelid suddenly puffed up. There was no doubt about its being emphysema. The location of the fracture of the bone could not be determined.

5. Exophthalmic goitre occurring in a child and followed by St. Vitus's dance. By A. JACOBI. *N. Y. Med. Rec.*, July 5th.

Dr. J. thinks all the phenomena of this disease can be referred to some disorder of the sympathetic. Of nerve-specifics he has found arsenic useful in treatment. Ergot he has also used with benefit. The same can be said of iron, quinia and all the tonics.

6. Forty operations for extraction of cataract by modification of Gräfe's method. By Prof. FROTHINGHAM. *Physician and Surgeon.* (*Mich.*) August.

The particular modification of Gräfe's method is not stated. Of the forty cases, thirty-five are reported as being "good" as to results, two "much improved" and three failures. In two cases suppuration of cornea ensued, but the principal complication was iritis.

7. Cystoid cicatrix; an operation for its radical cure. By D. S. REYNOLDS. *Louisv. Med. Herald*, August.

The treatment used by R. in thirty-five cases, with only one failure, consists in entering a fine curved needle, armed with ordinary white thread, into one-half the thickness of the cornea one line from the opening, passing it out through the centre of the raw surface and entering it at a corresponding point on the scleral edge, to be passed out one line from the scleral edge, "passing the thread external to the cystoid mass, and forcing the corneo-scleral lips together without breaking into the aqueous chamb., forcing the cicatricial mass to take position internal to the inner plane of the walls of the globe." The suture is then tied, and generally allowed to come away of itself.

8. Lachrymal catarrh. By D. B. ST. JOHN ROOSA. *N. Y. Med. Rec.*, Aug. 9.

Dr. R. thinks the origin of most cases of lachrymal catarrh is a catarrhal condition of the nose and pharynx. In treatment

he adopts Bowman's plan of slitting the canaliculus and probing.

9. On the therapeutic use of eserine in glaucoma. By M. LANDESBERG. *Phila, Med. Times*, Aug. 16.

Further experience has convinced L. that eserine cannot be relied upon as a remedy in glaucoma, and may be even pernicious in so far as it might lead to the deferring of proper measures.

10. A case of atrophy of the optic nerves; recovery. By J. A. LIPPINCOTT. *M. and S. Rept.*, Aug. 16.

A man 54 years of age, after an attack of *mania a potu*, began to suffer from a blurring of vision which was progressive until V. $= \frac{20}{LXX}$ in *R.* and $= \frac{30}{LXX}$ in *L.* V. F. much contracted and color perception diminished. His stimulants were stopped (tobacco allowed), and he was put on $\frac{1}{32}$ gr. strych. t. d., to be gradually increased, and electricity applied. Improvement soon began, and was progressive until V. $= \frac{20}{XX}$ in both. The V. F. was measured at intervals, and was progressively enlarged, and the color perception was restored to the normal.

11. Eserine in episcleritis. By W. W. SEELY. *Cin. Lancet and Clinic*, July 19.

Dr. S. was led to try eserine in episcleritis from its known action in contracting the blood-vessels. He has used it in two cases. In one a cure resulted in less than two weeks; in the other in ten days.

12. Optic neuritis as a symptom of intracranial disease. By W. F. NORRIS. *Phila. Med. Times*, Aug. 30.

All the theories on the subject are given. Dr. N. gives his adherence to the Schwalbe lymph-space theory.

13. Sympathetic ophthalmia. By JOSEPH A. WHITE. *Va. Med. Monthly*, Sept.

A résumé of our knowledge of the subject, with a case in which symp. oph. occurred in the sound eye after the removal of a stump lost by panophthalmitis (the stump being removed while the inflammation was in existence). Through active antiphlogistic treatment the eye was saved.

14. On a modified form of canula eye-forceps. By H. CULBERTSON. *Cin. Lancet and Clinic*, Sept. 6.

The modification in the canula eye-forceps which Dr. C. makes is to have the forceps *closed* when *at rest*. The instrument is introduced into the ant. chamb. in this condition, and when it has

reached the desired spot a lever is pressed upon which opens the blades; on removing the pressure they are closed.

15. Eserine in diseases of the eye. By C. J. LUNDY. *Mich. Med. News*, Sept. 10.

Dr. L. has found eserine useful in various corneal affections, in burns of the conjunctiva, and in one case of acute glaucoma. He considers its usefulness to arise from its power to diminish the calibre of the blood-vessels.

16. Forcible dilatation of the sphincter palpebrarum as a means of treatment in obstinate cases of blepharospasm. By H. G. CORNWELL. *N. Y. Med. Rec.*, Sept 27.

Dr. C. has found a forcible stretching of the orbicularis by means of the speculum introduced and allowed to open to its fullest extent, of most excellent service in the above-mentioned class of cases. The operation is to be repeated every day or two if necessary. He thinks the benefit is due to the stretching of the muscular fibres and the exposure of the nerves of the eye to light and air.

17. Salicylicate of sodium in rheumatic irido-cyclitis. By W. J. MCDOWELL. *Maryland M. J.* Oct.

Dr. M. reports two cases of severe irrido-cyclitis which were cut short by the administration of twenty grains of salicyl. of sod. every ten hours, or until "singing in the ears" set in.

18. Two cases of chronic blepharospasmus as traumatic reflex neurosis. By F. C. HOTZ. *Amer. Jour. Med. Sc.*, Oct.

Dr. H. reports two cases of blepharospasm due to alteration of nerves from traumatic injury. In one, the occipital was the nerve affected, in the other, the supra-orbital. Both cases were cured by inunction of the oint. of iodid. potass., over the seat of injury.

19. Observations on infiltration of the retina in lardaceous disease of the kidneys due to chronic suppuration from bone disease. C. S. BULL. *Amer. Jour. Med. Sc.*, Oct.

Dr. B. reports two cases of remarkable and extensive change in the retina, which was associated with albuminuria and hyaline and fatty casts, and enlargement of liver and spleen. In both there was bone disease. There was no autopsy, and Dr. B. considers the alteration lardaceous on general principles. The retinal changes were as follows: "The whole fundus as far forward as the ora serrata presented a brilliant dead white color strewn with red spots and lines which proved to be hemor-

rhages. The optic disk was invisible, but the vessels could be seen converging, though they disappeared from view at times in the infiltration. The infil. was most dense at the disk and the macula, and gradually thinned out towards the periphery."

The reporter has seen a somewhat similar appearance in the retinæ of a negro woman of 65, whose urine was highly albuminous. She, however, had no diseased bone, and no evidence of amyloid disease in any of the organs. The retinal picture was utterly unlike that of the typical ret. Bright., and differed from that described by Dr. B. only in this that the disk was still visible. A glaucomatous attack supervened in the left eye and entirely destroyed the little remaining vision she had on that side. The case has not yet come to a post-mortem.

20. Forty-eight hours blindness at the parturient period. By F. F. ANGEAR, *St. Louis Med. and Sur. Jour.*, Oct.

A woman within a few weeks of confinement, was seized with a sudden blindness—with no accompanying symptoms. On examination, the os uteri was found moderately dilated, but there was no contraction of the uterus. Labor was brought on which terminated successfully, and in forty-eight hours from the time the patient first became blind she could discern objects. The progress of the case was then to perfect recovery. No account is given of the ophth. appearances.

21. Hyperostosis and periostosis of the bones of the orbit. Illustrated by two cases. By C. S. BULL. *N. Y. Med. Jour.*, Nov.

Dr. B. calls attention to the distinction between hyperostosis where the bony tissue is simply enlarged independent of any trouble in the periosteum, and periostosis where the origin of the trouble is in the periosteum. They may, however, be combined in the same case. These affections of the bones composing the orbit are considered by Dr. B. to be rare, he having met only two cases in over 16,000 cases.

22. Neurotomy instead of enucleation. A new operation. By J. J. CHISHOLM. *Va. Med. Month.* Nov.

Dr. C. gives the histories of seven cases in which he has performed this operation in symp. oph. with success up to the time of publication of his paper. In speaking of the operation, no mention whatever is made of the work done by others in the same field, and there is nothing in the article to show that the operation is not one devised by Dr. C. This may have been entirely unintentional, but a paper devoted to the consideration of this

subject, in which the names of Rondeau, Boucheron and Schœler are not even mentioned, reads very strangely to those who are aware of their labors in that direction.

23. Optico-ciliary neurotomy. By Dr. WADSWORTH. *Bost. Med. and Surg. Jour.*, Nov. 27.

Dr, W. showed to the Bost. Soc. for Med. Improvement, two patients on whom he has performed this operation for symp. oph., with success.

24. On the therapeutic use of Duboisia in eye diseases. By M. LANDESBERG. *Med. and Surg. Rep.*, Nov. 29th.

Dr. L. finds Duboisia more prompt and powerful in its action than atropia, and an excellent substitute for the latter when on account of idiosyncracy or irritating effects it cannot be used. He has seen constitutional symptoms follow its energetic use in only two cases.

25. Lectures on Cataract. By G. E. FROTHINGHAM, *Physician and Surgeon.* (*Mich.*) Oct., Nov. and Dec.

A general consideration of the nature, causes, appearances, etc., of cataract, and its treatment by operation. He uses the Gräfe method, with no other modification that we can see than a less peripheral situation of the incision. He prefers an anæsthetic except in perfectly reliable patients.

26. Traumatic neuro-retinitis. Diagnosis complicated by myopic astigmatism. By S. D. RISLEY. *Med. Herald*, Nov.

A man, 37, received a blow in the left eye by a piece of wood in 1877. Saw Dr. R. in Sept., '79. Astig. corrected and V. brought to $\frac{20}{XXV}$. In Oct. V. in *L.* $\frac{20}{LXX}$ and there was haziness at m. l. The inner and upper quadrant of V. F. completely lacking, and V. F. in the other quadrants concentrically narrowed. Color perception impaired.

27. Optic neuritis. By W. DICKINSON. *St. Louis Med. and Sur. Journ.* Dec.

A formal statement of our present knowledge of the subject. No cases are given.

28. Injuries of the eye. By ROBT. SATTLER. *Cin. Lancet and Clinic*, Dec. 20th.

After some general considerations, Dr. Sattler gives some interesting cases. One in which a beard of wheat had lain for months in the upper fornix conjunctivæ. One where a flax-seed and another where an eye-stone were the causes of irritation for months, and several other cases where foreign bodies had lodged in the

conjunct. and cornea, and whose presence was unsuspected by the patient. Attention is also given to burns of the cornea from lime, lye, acids, etc. In his treatment of these latter cases he recommends ice applications and drops of ol. ricin. with atropine. In removing intra-lamellar foreign bodies he has found it a good plan to introduce a lance-shaped knife in the ant. chamb. behind the body. This affords a firm basis to work on and prevents the body falling into the ant. chamb.

Three cases of foreign bodies in the ant. chamber, which were removed by delicate forceps after a linear incision (downward) are given. In all three the operation was successful. In two of the cases a piece of the iris was cut off. In one case a piece of metal had become encapsulated in the iris, and was removed with the portion of the iris in which it was embedded. He advises in cases where the foreign body is in the iris to wait for a time before attempting removal, because after inflammatory matter is thrown out around the body there is less chance of its falling into the ant. chamb. during an attempt at removal. A successful removal of a lens with a foreign body in it is reported.

29. The effect of the optical condition of the eye on the development of character. By E. G. LORING. *Trans. N. Y. State Med. Soc.*, 1879.

Dr. L. dwells earnestly on the evil effects on the mind and body by uncorrected optical defects, and urges that every child before being placed at school should have its eyes examined as to their refractive condition. This can be done by general practitioners, and he offers a set of trial glasses composed of six concave and six convex spherical and 4— and 4+ cyl. glasses, which by their various possible combinations will fulfill all requirements.

30. Sulphate of eserine in the treatment of acute glaucoma. By T. R. POOLEY. *Ib.*

Dr. P. gives the histories of four cases in which eserine was used with good effect in acute glaucoma, producing a reduced tension in every case.